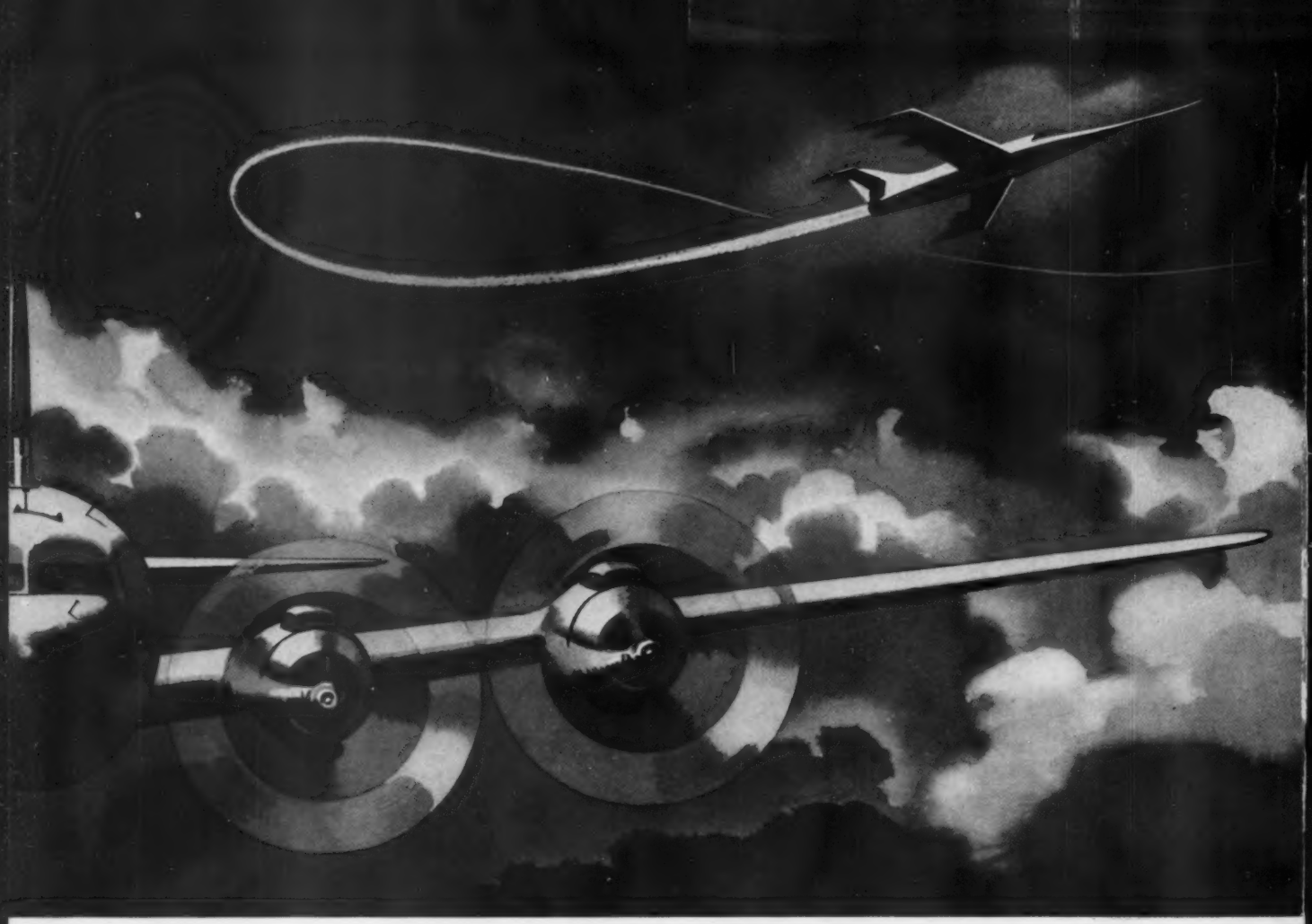
PRICE 50 CENTS

American Machinist

JULY 4, 1955

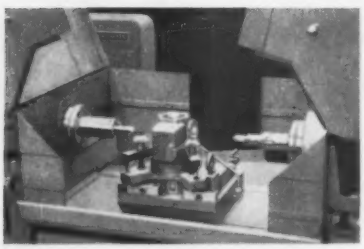
McGRAW-HILL MAGAZINE OF METALWORKING PRODUCTION

MODERN MACHINES PRESERVE `LIBERTY THROUGHOUT THE LAND...



the finest precision parts

are finished on Heald machines



FIVE DIFFERENT JET ENGINE PARTS
ON ONE
HEALD BORE-MATIC

The Model 322 Bore-Matic shown above borizes critical surfaces on five entirely different jet engine components — each with a different fixture and tooling setup. Easily interchangeable fixtures and boring tools enable this one machine to perform a variety of semi-finishing and finishing operations on the different parts — with minimum down-time for changeovers.

From supersonic jets to commercial airliners — *precision* is vital to sustained flight, accurate navigation, safe landings and take-offs. That's why so many aircraft parts today are precision finished on Heald Bore-Matics, Internals and Rotary Surface Grinding Machines.

Jet engines, reciprocating engines, propeller parts, landing gear, aircraft instruments, sighting devices and guided missiles—all require the extreme accuracy and precision that have become almost a tradition with Heald machines.

Whether the job calls for long runs or frequent changeovers, you'll get maximum precision plus maximum production on a Heald. Moreover the aircraft industry is just one of many where new Heald equipment is paying off *right now* in terms of lower costs, larger profits and better product. May we serve you, too?

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WORCESTER 6, MASSACHUSETTS
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American Machinist

MAGAZINE OF METALWORKING PRODUCTION

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NUMBER OF COPIES PRINTED THIS ISSUE 38,710

chips

THE BELL . . . Because of the coincidence of our issue date with Independence Day, we felt we should have something quite different on our cover. The consequence is this one by our art director, Richard Rooman. We have taken the wording off the original Liberty Bell: "Proclaim liberty throughout all the land unto all the inhabitants thereof," as our theme, and tried to show that machines are the primary *preservers* of our liberty. Support for this thought is presented in the 8-page foldout Special Report in the issue. Growing out of the very popular one in *AM* for Dec 20, '54 this one enlarges the "machine-tool tree" and provides additional data. Copies are available for posting.

TOXIC MATERIALS . . . Back in 1951 we published the first description of enclosures for machine tools to be used in machining beryllium. Now we bring the story up to date with details of the new enclosures in use at Argonne National Labs, showing changes resulting from experience with the earlier ones. Here are answers for a potentially very-serious problem.

TAP TROUBLE . . . Howard Urban, in our lead article, shows a variety of things that can go wrong with taps, plus the vital data on how to detect and cure them. Here is a clinical discussion that will help you.

STAINLESS . . . Reports indicate that Imperial Knife Co, up in Providence, RI, is doing an excellent job in fabricating stainless. We checked . . . and agree. Some of the ideas applicable to other jobs on stainless are pictured and described in this issue.

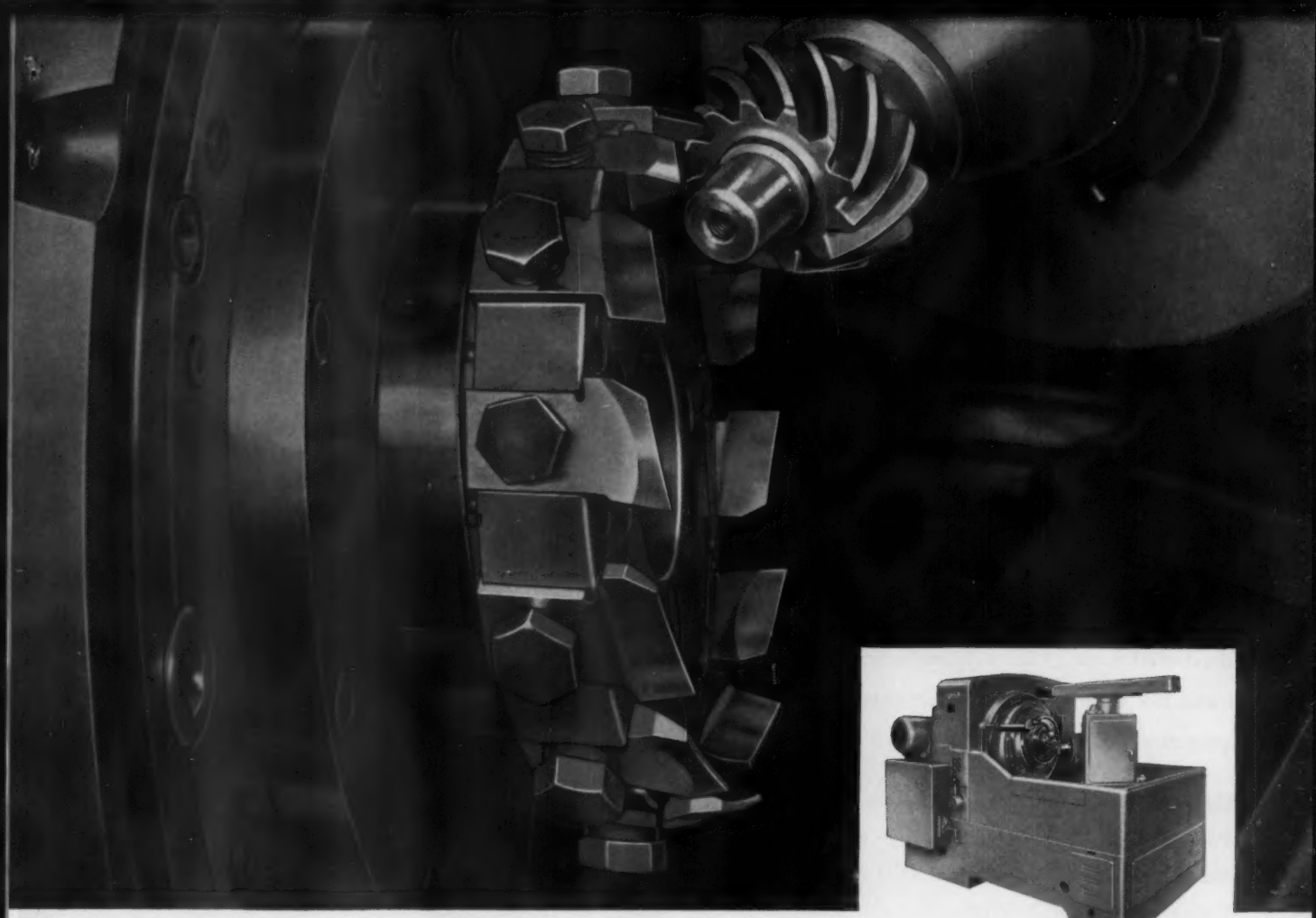
SLIDES . . . Up at Simmons Machine Tool, shop men designed and built an assembly machine for slides for slide fasteners. Four parts are hopper fed. Here's another application of the latest trend in automation—toward automatic assembly. And the slide is snag-proof, too. . . . Another "home-made" machine was produced at Bristol Engrg, a frame with a hydraulic jack. Presto! A press for developmental parts.

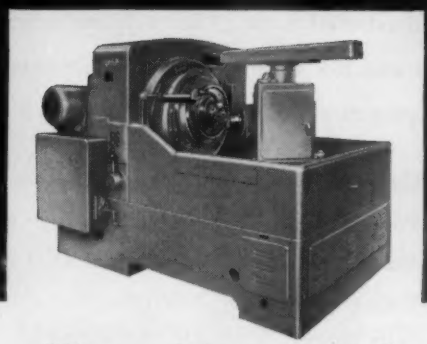
TOOLING . . . E F Katzke, lapping technician at Crane Packing Co, gives you five examples of things to watch when lapping. Here are good pointers. . . . As a third article on tooling, we have four pages, from S G Johnson, chief engineer of Barber-Colman, interpreting for you the fits obtainable for involute splines based on the rather involved American standard.

PLATING . . . Helipot Corp makes potentiometers. Parts require cadmium or gold plating, Alumiliting in green, black, blue or clear. To control quality, individual dc supplies each tank, and temperature is under rheostat control. Here is precision plating in two tight pages.

COMING . . . *AM* for July 18 will include a Special Report on tricky tooling used by GE in producing watt-hour meters, articles on hobbing, use of a drill on a progressive die, projection welding and a forecast of what you'll see at the Machine Tool Show.

NEWS SLEUTH . . . For the past 2½ years, those sparkling headlines and paragraphs in our news pages have been the work of Robert Sheets, news editor. He grew up around Chicago and had his degree in journalism from Northwestern U in 1938. (He has also had seven months at the Chicago Academy of Fine Arts!) His work at Western Newspaper Union from '39 to '41 was terminated by sudden membership in the US Army, where he was war correspondent with the 2nd Armored Division until June, '45, in seven campaigns in North Africa, Sicily and Europe. Managing editor of *Electric Light & Power* from July, '45, to Mar, '48, of *American Foundryman* until July, '52, then of *Armed Forces News* for six months, he came to *AM* in January, '53.





Jobbing or production quantities are efficiently handled with the new Gleason No. 106 Hypoid Generator.

This new generator cuts medium-size bevel gears *faster than ever!*

Several things have been done to make this new Gleason No. 106 Hypoid Generator the fastest machine for producing medium-size bevel gears.

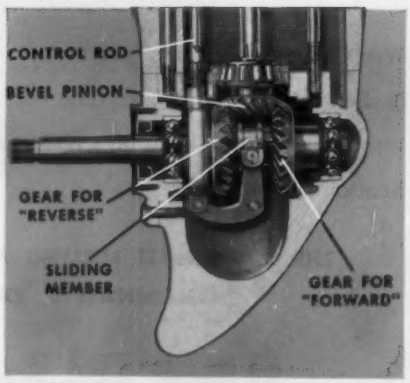
For example, new generating and feed mechanisms coupled with rigid construction give more efficient cutting cycles, speeding up cutting time. In addition, the new generating method assures excellent finish, and maximum cutter life.

Few adjustments required

Since fewer adjustments are necessary, faster setup and change-over are attained.

Extreme operating flexibility is one of the outstanding features of the 106. This permits its use for jobbing, production and completing. When it is arranged for completing, gears are finished directly from the solid blank.

This machine handles gears from 2″ to 8½″ diameter, 4DP and finer, with ratios up to 10/1, cone distances up to 5¼″. We will gladly send you more details on request.



Spiral bevel gears similar to those in this outboard motor drive are cut accurately and quickly on this Gleason machine.

GLEASON WORKS

Builders of bevel gear machinery for over 90 years

1000 UNIVERSITY AVE., ROCHESTER 3, N. Y.

Do Extremes in Lot Sizes

This Cincinnati Automatic Combines Rapid Production with Quick Setup

Forget about the number of parts per lot. Just consider one thing: can your milling operations be assigned to a 3 hp automatic? If the answer is yes, CINCINNATI No. 1-18 Plain Automatics will save money for any shop where quantities vary widely. ¶ Two extremes in lot size are illustrated here. You will immediately recognize how these No. 1-18 features are of value in low-cost milling operations for any lot size from two dozen to thousands:

Completely Automatic Table Traverse Cycles
Power Rapid Traverse, 300 inches per minute
Sixteen Spindle Speeds, 50 to 1500 rpm
Sixteen Two-Way Table Feeds, ¾ to 30 in. per min. (Higher and lower series available)
Finger-Tip Control of Table Cycle
Speeds and Feeds Changed Without Wrenches
Automatic Backlash Eliminator
Automatic Spindle Stop
Handwheel Adjustment and Lever Clamp of Quill

Want more information? Brief specifications will be found in Sweet's Machine Tool File, and complete data in attractive 24-page catalog. Write for your copy . . . publication No. M-1555-2.

THE CINCINNATI MILLING MACHINE CO.
CINCINNATI 9, OHIO

MACHINE TOOL SHOW
INTERNATIONAL AMPHITHEATRE
CHICAGO, ILL.
SEPT. 6-17, 1955
BOOTH 1205

Lot Size—24

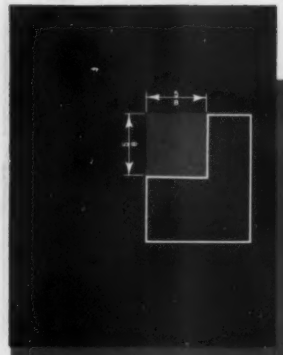
FIRST OPERATION: MILL STEP
Set up vise, arbor and cutter..... 16 min.
Mill 24 parts..... 39 min.

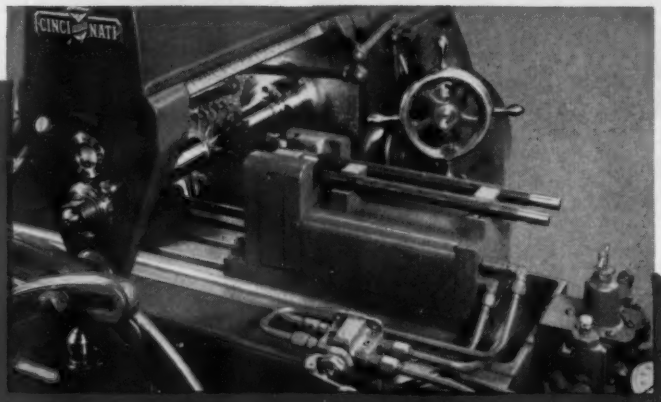
SECOND OPERATION: MILL 3° ANGLE
Fit angle setting element in vise, adjust knee and quill..... 4 min.
Mill 24 parts..... 39 min.

THIRD OPERATION: MILL CHAMFER
Change cutter, remove angle setting element, adjust knee and quill..... 9 min.
Mill 24 parts..... 27 min

Upset Your Costs?

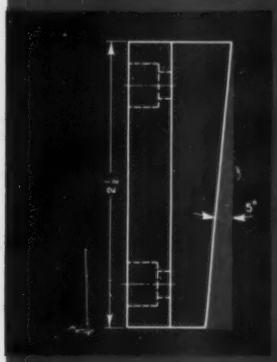
Lot Size—Thousands



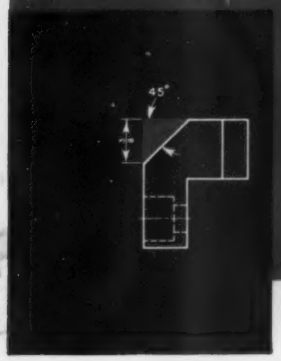


800 shafts per hour, straddle milled on this **CINCINNATI No. 1-18 Plain Automatic,** employing an automatic reciprocal milling cycle, and equipped with labor-aiding fixtures designed and built by Cincinnati.

Drawing shows milled ends of parts, and automatic cycle.



CINCINNATI No. 1-18 Plain Automatic Milling Machine. You may obtain complete information by writing for catalog No. M-1555-2.



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MILLING MACHINES • CUTTER SHARPENING MACHINES • BROACHING MACHINES • METAL FORMING MACHINES • FLAME HARDENING MACHINES OPTICAL PROJECTION PROFILE GRINDERS • CUTTING FLUID

THE BULLARD COMPANY tools-up

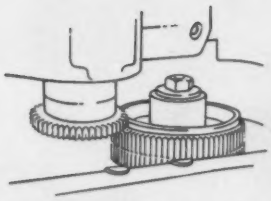
SEVENTY FIFTH
BULLARD
ANNIVERSARY

New HEAVY DUTY Fellows No. 12
Gear Shaper for internal or external gears up to 12" p.d. x 4" face. 44 to 550 strokes per minute.

New HIGH-SPEED Fellows No. 4GS
Gear Shaper for internal or external gears up to 6" p.d. x 2" face. 98 to 635 strokes per minute.

THE *Fellows*

with FELLOWS new "heavyweights"



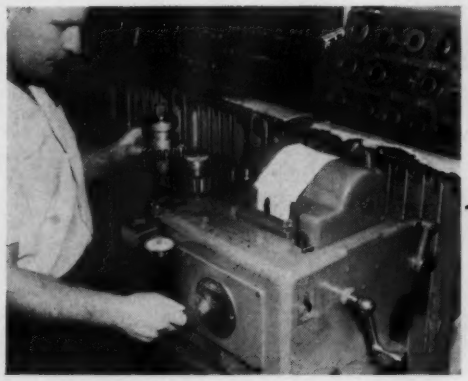
When Bullard needed more spur and helical gear cutting capacity at their big Bridgeport plant, they looked to Fellows' NEW HEAVIER DUTY MODELS.

A NEW NO. 4GS and a NEW NO. 12 have been added to Bullard's two 36-Types—giving them maximum output capacity per unit of floor space—and size capacities for all the spurs and helicals in their modern Mult-Au-Matics, Horizontal Boring Machines, Cut Master and Man-Au-Trol Vertical Turret Lathes.

All three types of Gear Shapers in this battery have a wider range of speeds and feeds than previous models. They hold to closer tolerances while taking heavier cuts—and consequently produce more gears at a lower cost.

These new-model Gear Shapers have a cost cutting potential for any shop involved in heavy production schedules. The nearest Fellows Branch Office will be glad to estimate the possible savings on your gears—and present the Fellows Plan to those who may wish to consider term payments.

←**ALL-PURPOSE Fellows 36-Type**
Gear Shapers for internal or external gears up to 36" p.d. x 6" face.
18 to 300 strokes per minute.



←Bullard Company also relies on Fellows "Red Liners", Lead Measuring and Involute Inspection Instruments for CHART-RECORDED PROOF of gear accuracy to keep costs and quality under constant control.

GEAR SHAPER COMPANY

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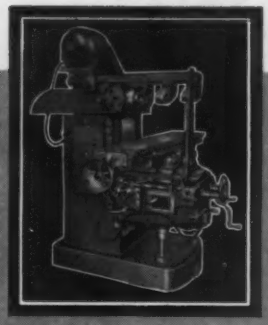


Why Buy Two When

ONE VAN NORMAN Ram Type Miller

Gives You the Workability of Two Single-Purpose Machines

Increases Your Production... Cuts Your Investment Costs!

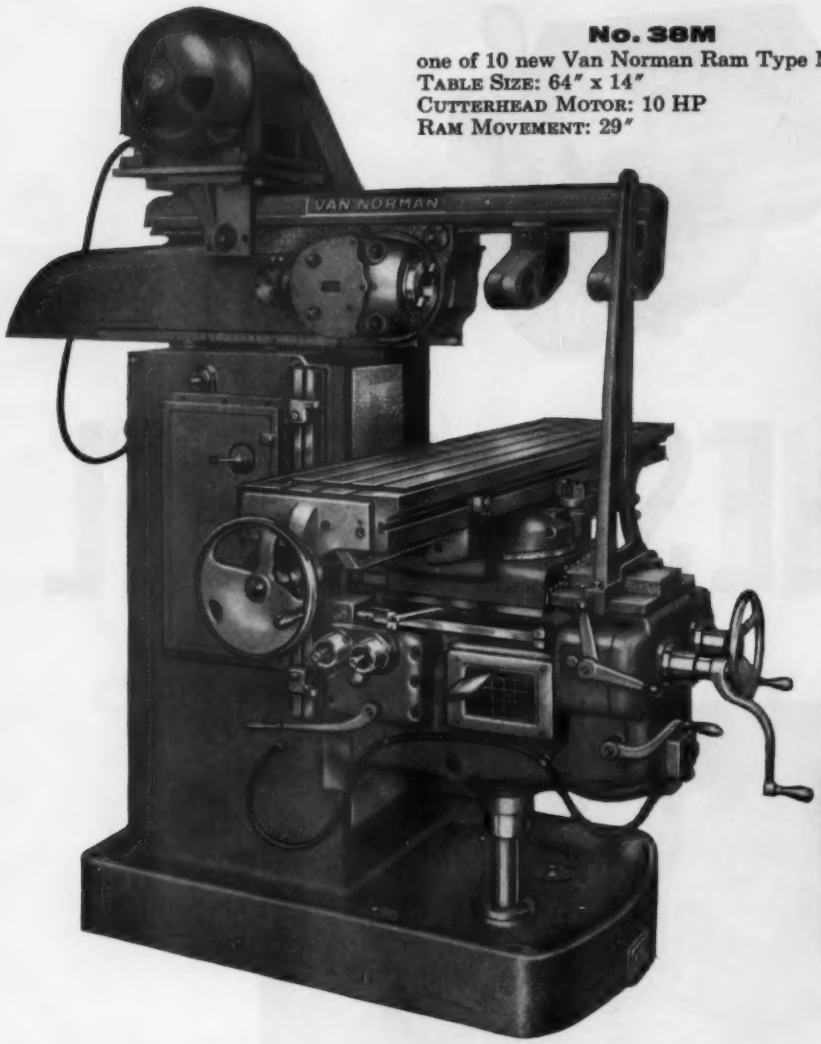
Don't wait . . . for extra profits install a Van Norman Machine now! They are available on five purchase plans — Outright sale . . . Purchase on conditional sales contract up to five years . . . Pay as you depreciate . . . Straight lease . . . Lease with option to buy. See your dealer or write Van Norman Company.

Lease and Conditional Sales Contracts not available to Export

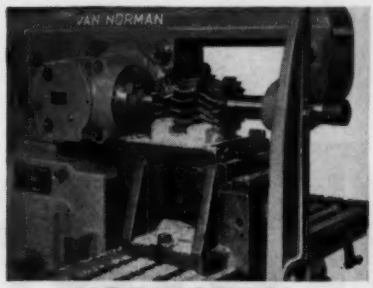
VAN NORMAN

MANUFACTURERS OF — Ram and Column Type Milling Machines, Cylindrical Grinders, Spline and Gear Grinders, Oscillating Radius Grinders, Special Production Grinders, Centerless Grinders.

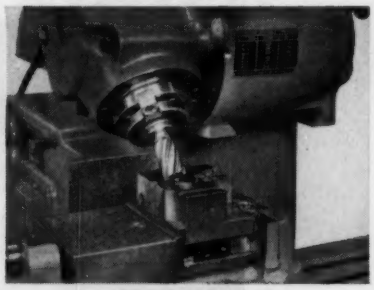
No. 38M
one of 10 new Van Norman Ram Type Millers
TABLE SIZE: 64″ x 14″
CUTTERHEAD MOTOR: 10 HP
RAM MOVEMENT: 29″



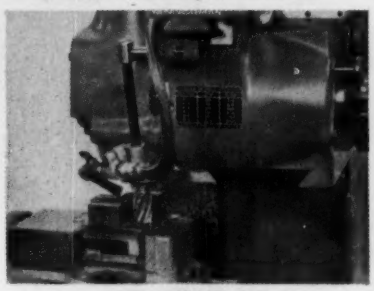
HERE'S HOW IT WORKS



HORIZONTAL
A heavy horizontal milling cut performed on the miller. Over-arm and outer brace provide maximum rigidity and accuracy.



ANGULAR
An angular milling operation is being performed on a workpiece. Angular range of cutterhead is 0 degrees to 90 degrees. Accurate positioning is simplified by easy-to-read graduations.



VERTICAL
With the cutterhead locked in the vertical position, a vertical milling operation is performed on the work piece.

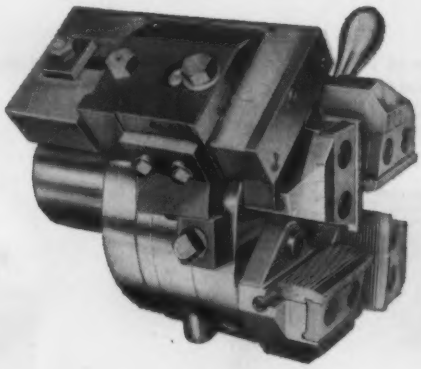
For the price of *one* Van Norman Ram Type Milling Machine without attachments, you get the workability of two single-purpose millers with attachments. This means you save on capital expenditures, yet do not cut down on production.

With the Van Norman Miller you do horizontal, vertical, as well as angular milling on one machine. The result — you keep the miller working at capacity every shift. You eliminate idle machine and worker time . . . increase production.

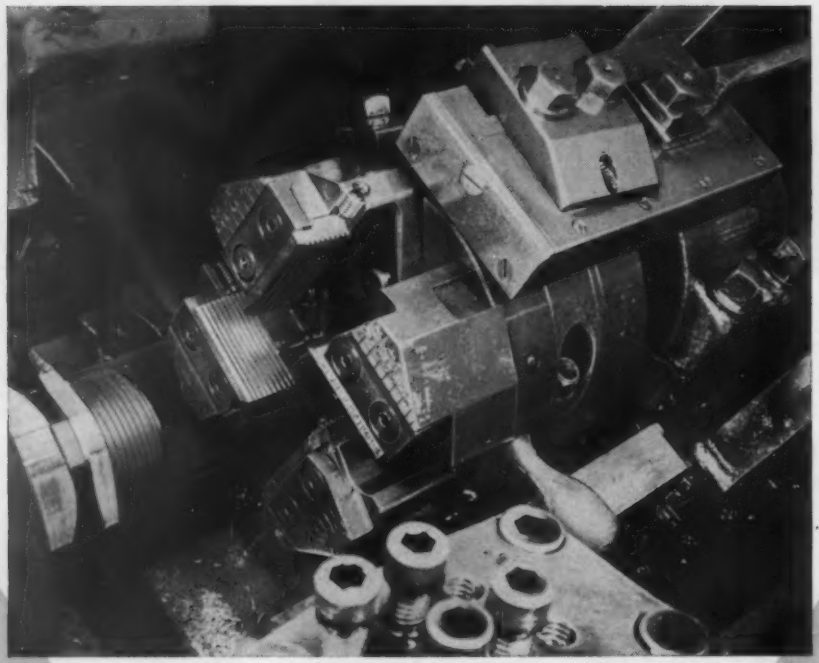
Ten new models with cutterhead motors ranging from 1½ HP to 10 HP and table sizes from 37½″ x 9³⁄₁₆″ to 64″ x 14″ give you a wide range of selection. Write for complete information, today.

COMPANY

SPRINGFIELD 7, MASSACHUSETTS



STAINLESS STEEL



This equipment displayed at:

THE MACHINE TOOL SHOW
BOOTH 1406

TAPERED THREADS

cut with Better Finish Longer Tool Life

1½" Tapered Pipe Threads are cut in 304 stainless steel reducing bushings at Camden Machine Company, New Haven, Conn. These threads are produced by a 1¼" LANDMATIC Taper Attachment Head on a 3¼" Gridley single-spindle automatic at 15 surface feet per minute.

The thread finish is greatly improved from previous methods and 1000 pieces are completed between chaser grinds—an increase of more than 10 times.

These improved results can be entirely attributed to the use of the Taper Attachment and the free cutting action of the Landis Tangential Chaser. In operation, as the die head advances onto the workpiece, the movement of the die head cam along the cam follower of the taper attachment expands the chasers on diameter. This produces a tapered thread corresponding to the taper of the cam follower. Cutting action is limited to the throat section or chamfer of the chaser, allowing the thread to be cut quickly with little "cold-working." This action reduces cutting strains to a minimum and results in uniform tapered threads.

LANDIS Taper Attachment Heads are stationary self-opening heads for cutting tapered threads of all types. Six sizes of heads thread all diameters from ¼" to 6".

When writing for additional information, ask for Bulletin F-90.

THE WORLD'S LARGEST MANUFACTURERS OF THREADING EQUIPMENT - CUTTING - TAPPING - GRINDING - ROLLING

LANDIS *Machine* COMPANY

WAYNESBORO • PENNSYLVANIA • U. S. A 414-C

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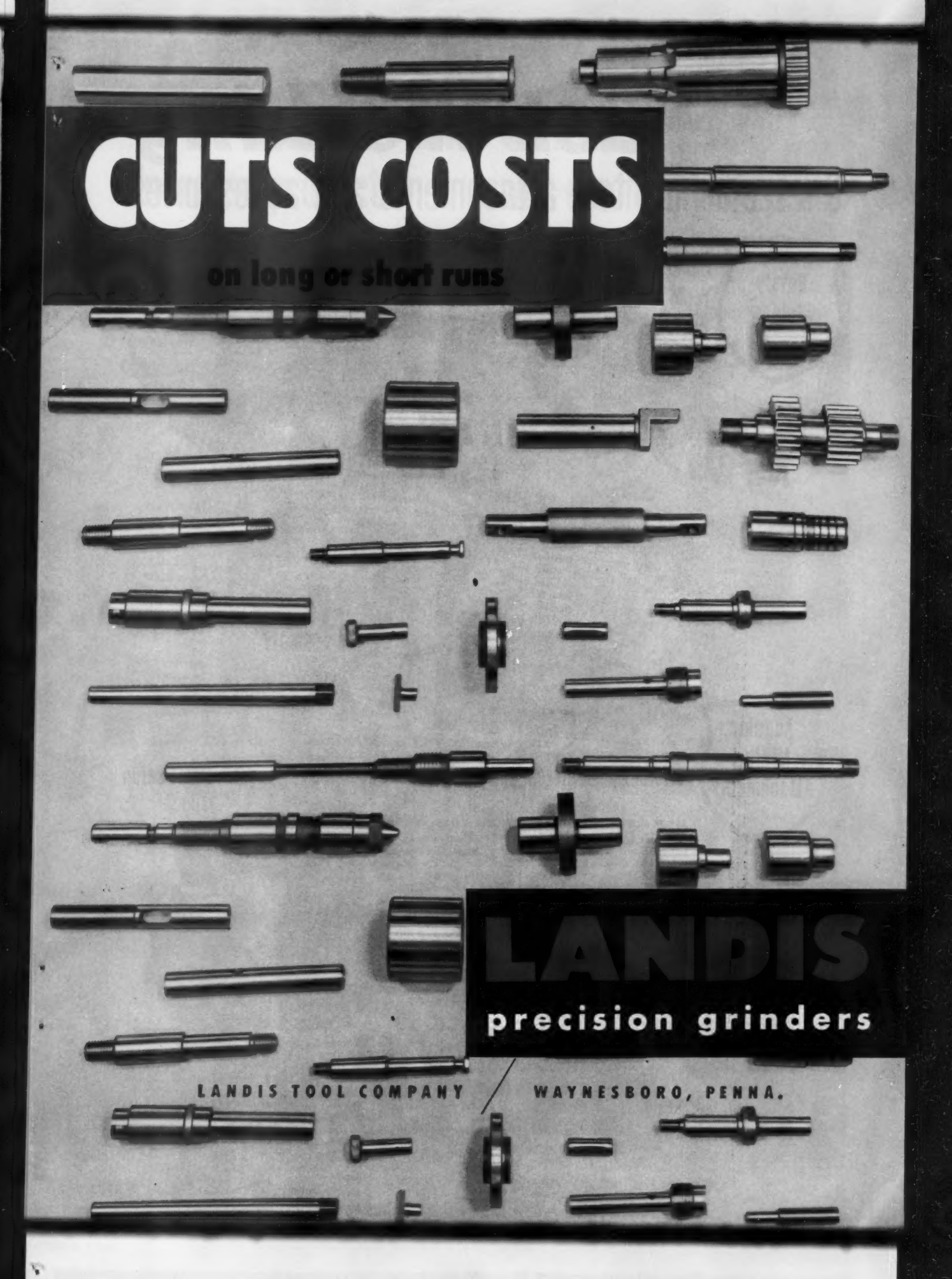
THE MACHINE TOOL SHOW
CHICAGO, ILL.


CUTS COSTS
on long or short runs
LANDIS
precision grinders
LANDIS TOOL COMPANY
WAYNESBORO, PENNA.

Fast-Working

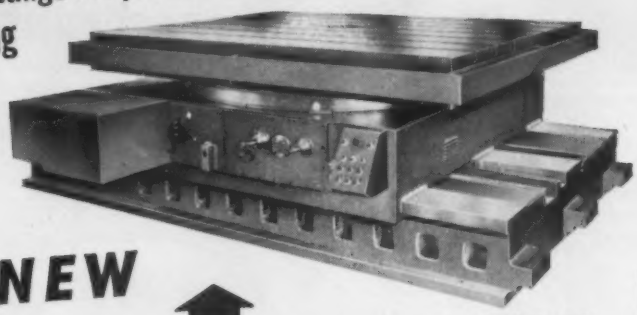
G & L machine tool attachments and accessories

Rotary Tables

reduce number of work settings . . . provide rapid and accurate indexing

NEW

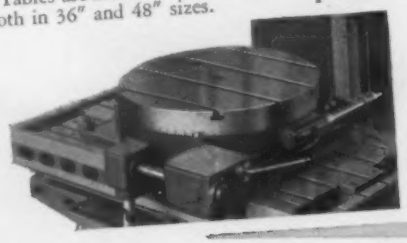
NEW Giddings & Lewis Air-Lift rotary table eliminates multiple setups and is capable of 90° indexing off center loads. By turning a valve, air is forced into the unit, raising the table .001". With air acting as bearing, table "floats on air" . . . can be indexed to desired position . . . and firmly settles on non-lubricated seat. There's no oil film to disturb the accurate setting. Tables are available with round or square platens, both in 36" and 48" sizes.



NEW

The NEW 8-ft. power-driven, precision rotary table is built to support 50 tons. Ample powered motors provide feed and rapid traverse, and unlimited travel on 8-ft. runway width. It's equipped with a precision indexing device, graduated in .001".

Adaptability of this powered table enables the machine to do more jobs . . . eliminate numerous setups and the necessity for several special machines.



Giddings & Lewis plain or hand and combination power feed tables provide fast, accurate indexing and make it possible to machine a number of surfaces in a single setup. They're available in round, square and rectangular platens in various sizes.

Hand feed rotary tables — 24" and 30".

Plain rotary tables — 24", 30", 36" and 48" (round); 30", 36" and 48" (square).

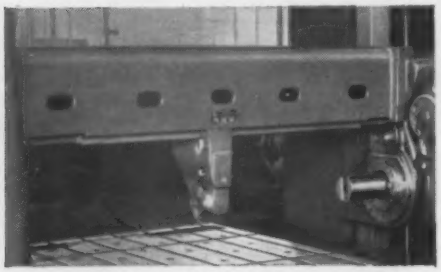
Combination plain, hand and power feed rotary tables — 36", 48" and 60" (round or square) and from 36" to 60" x 96" with intermediate sizes for rectangular platens.

Angular Milling Attachments

perform many different milling operations at various angles in a single setup

ARBOR SUPPORT (cross rail)

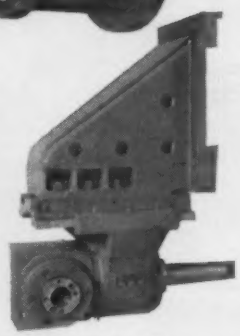
This accessory unit with different length cross rails, which move up and down with the headstock and end support block, meets the requirements of various table widths. It's possible to set milling cutter at any position over the table. Thus with single or multiple supporting arms on the cross rail, it's easy to perform slab, gang and straddle milling operations. Arbors up to 3" diameter can be used.



MODEL A (single spindle)

This 90° angular milling attachment offers unusual flexibility for machining hard-to-reach surfaces. Head swivels 360° in a plane at right angles to the machine spindle. Head flange is graduated in ½ degrees. Adaptors of different lengths permit placing of cutting tool from 24" to 42" from headstock.

Other angular milling attachments, not illustrated here, include light, medium and heavy duty (single and two-spindle types) and special models.



MODEL D (sliding head)

This right angle, sliding head, heavy duty head with a variable reach is practical for heavy milling, boring, drilling, reaming, etc. Provided with an adjustable overarm support, the head swivels 180° and may be extended up to 19".

Model F, medium duty, angular attachment is also available for machining operations at any angle in large openings and cavities. According to machine size, milling head may be extended 48", 60" or 72", and operates at same speed as machine spindle. Feed is obtained by spindle traverse.

Profit-Makers!

increase production... lower machining costs

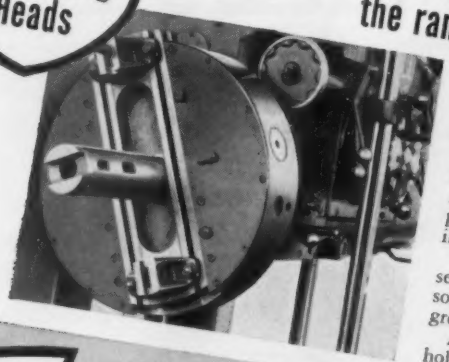
You get more production at lower cost and realize greater profits with Giddings & Lewis Horizontal Boring, Drilling and Milling machines when they're equipped with complete auxiliary attachments. It's common knowledge that no other machine can equal the wide variety of standard and unusual operations which a G&L machine can perform. Because it's so versatile, the operator can complete the job faster . . . considerably reduce floor-to-floor time . . . practically eliminate costly resetting and relocating of the workpiece.

Illustrated here are only a few of the attachments offered by G&L. If you're searching for an all-purpose machine plus a combination of profit-making attachments, call our nearest Giddings & Lewis representative. He'll give you all the details.

Write for Literature: Continuous Feed Facing and Boring Heads — A-10; Rotary Tables — A-20; Angular Milling Attachments — A-30; Set-Up Accessories — A-40.

Continuous Feed Facing and Boring Heads

efficiently handle a wide variety of operations well beyond the range of the machine spindle



This attachment is available for G&L Horizontal Boring, Drilling and Milling machines in 300, 30, 50 and 70 Series. Mounted on the machine headstock or on a line boring bar, it efficiently handles a variety of operations on circular flat surfaces, and external and internal cylindrical surfaces. It imparts a rotary motion with continuous feed. The tool slide is provided with six power feeds in both directions, independent of the spindle feed. A micrometer dial registers feed in increments of 0.001".

The Continuous Feed Facing and Boring head can be used separately or in combination with other attachments and accessories for turning, facing, counterboring, recessing, threading, grooving, forming, back facing, etc.

Also available are telescopic, right angle and facing tool holders, and a high speed grinder.

Improved Measuring Device

Improved Measuring Device is for work where readings to 0.0001" are required as compared with readings to 0.001" permitted by the standard machine scales and verniers. For use with G&L Table Type machines only, the device allows for extremely precise measuring of vertical travel of the headstock and cross travel of machine table on the saddle. A similar device for measuring saddle movement can also be supplied. Precision end rods for use with the device are available in complete sets or as individual units.

Box-type angle plates and parallels

Parallel block — Box-type parallel — Box-type angle plate

Parallel blocks and box-type parallels are precision machined for both squareness and parallelism. They're available in a broad range of sizes — solid block of alloy steel; ribbed, close-grained cast iron, and full box-type with T-slots on top and sides.

Box-type angle plates, made of one-piece castings, are available for precision milling or boring vertical surfaces of workpieces, either at right angles or parallel to the machine spindle. T-slots and locating keyways are planed to close tolerances.

GIDDINGS & LEWIS MACHINE TOOL CO.

FOND DU LAC, WISCONSIN

Builders of the world's finest heavy-duty Horizontal Boring, Drilling and Milling Machines — table, floor and planer types; Hypro Double Housing and Open Side Planers, Planer Type Milling Machines and Vertical Boring Mills; and Davis Cutting Tools.

and in this corner. .

Cincinnati Filmatic 4" Plain Hydraulic Grinders Produce Big Volume of Precision Parts in Small Space

In the corner or on the "main drag" of many shops you will find CINCINNATI FILMATIC 4" Plain Hydraulic Grinders doing an outstanding job; producing low-cost, high accuracy parts in big volume. Read how these efficient producers of high accuracy parts fit into your production schedule:

VERY LITTLE MAINTENANCE

FILMATIC bearings have eliminated spindle bearing adjustment and refitting. Automatic pressure lubrication greatly extends useful machine life span.

EASY TO SET UP

Table traverse rates are dial selected. Two-speed hand table traverse. Pickfeed increments are dial selected. Screw and lever type footstock.

ACCURATE

Sizing adjustments of .0001" on work diameter actually obtained. The table consistently reverses within .001". Full length support for table at extreme ends of travel.

HIGH VOLUME PRODUCTION

Single lever control for table traverse, work rotation and grinding fluid eliminates unnecessary movements of the hands. Two-speed grinding wheel drive restores grinding efficiency after wheel wears. Several production type attachments available.

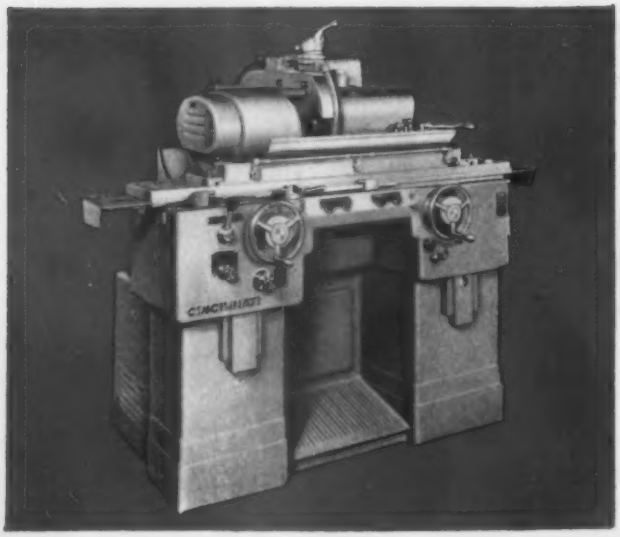
SMALL FLOOR SPACE REQUIREMENTS

Cutting fluid settling tank within bed readily removed for cleaning. Electrical controls recessed in bed. Only 84" x 54" floor space required, maximum travel.

Look into the many additional advantages offered by CINCINNATI FILMATIC 4" Plain Hydraulic Grinding Machines. Call your nearest Cincinnati Milling and Grinding Machines Inc. direct office or sales representative, or write for a copy of our catalog No. G-551-3.

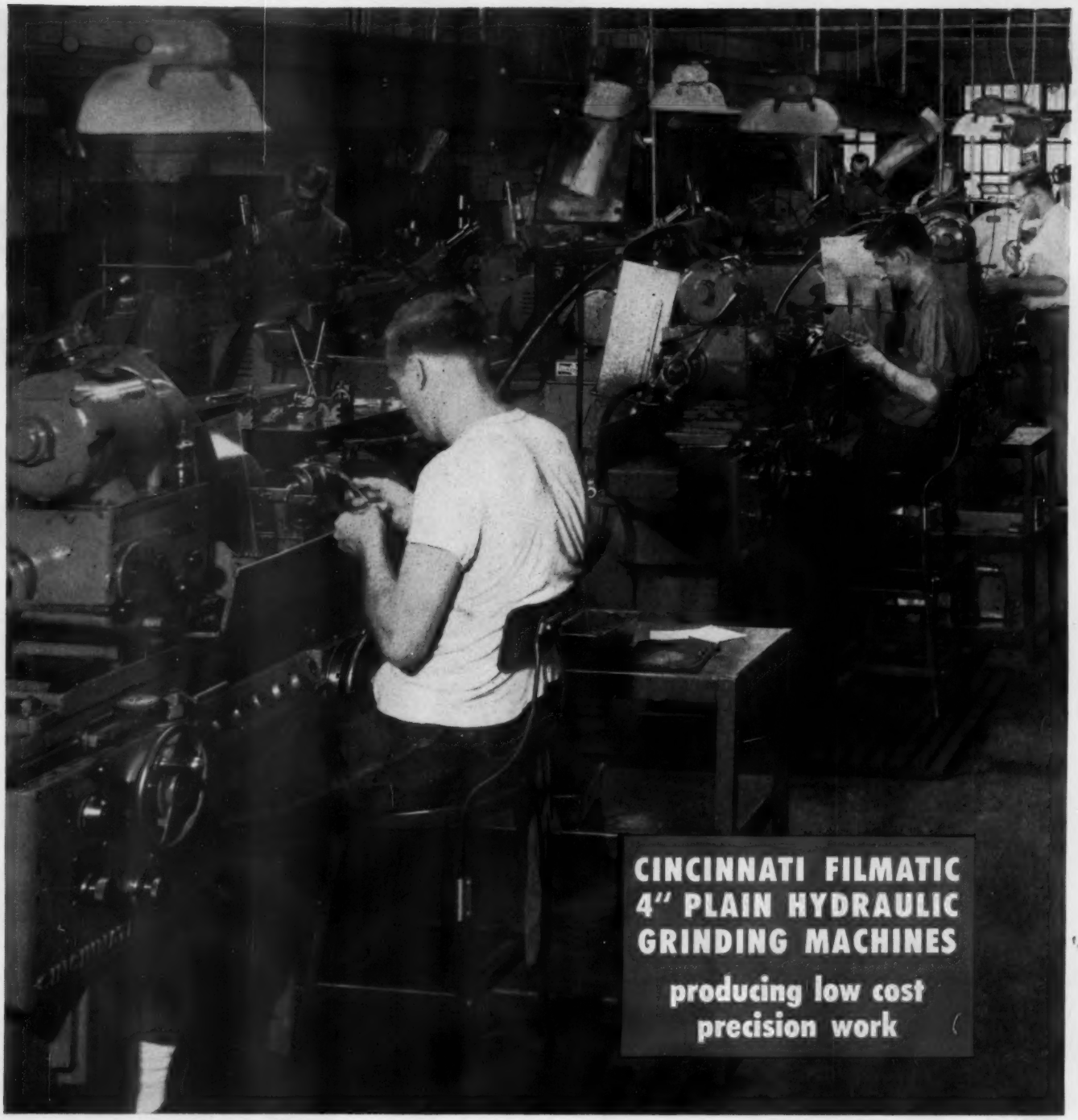
CINCINNATI GRINDERS INCORPORATED
CINCINNATI 9, OHIO

FILMATIC



CINCINNATI 4" Plain Hydraulic Grinding Machine. Complete specifications may be obtained by writing for catalog No. G-551-3. Brief data in Sweet's Machine Tool File.

CINCIN



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SEPT. 6-17, 1955

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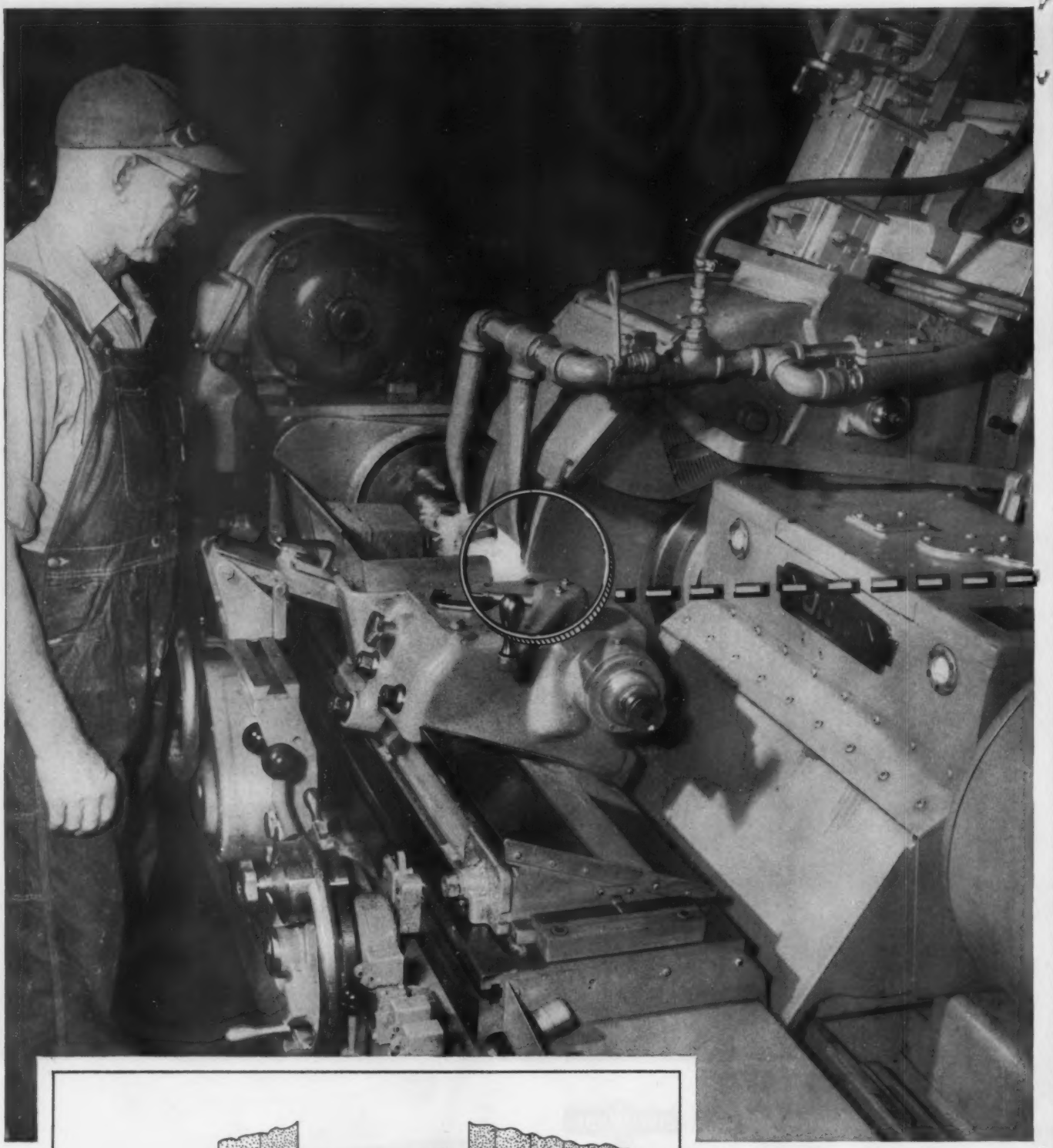
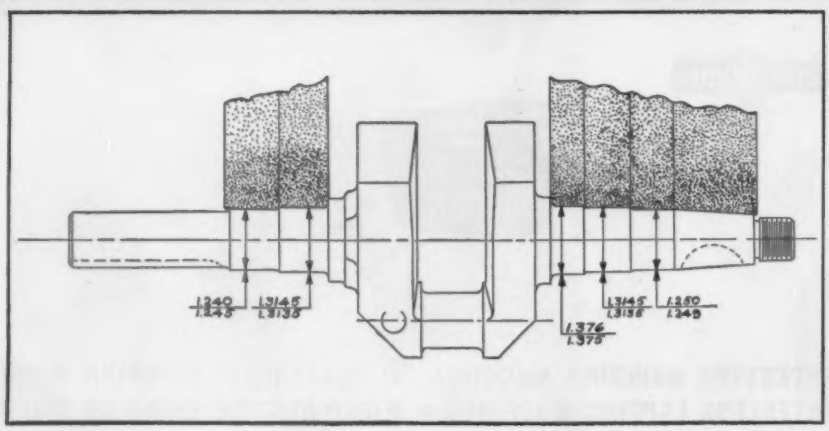
CENTERLESS LAPPING MACHINES • MICRO-CENTRIC GRINDING MACHINES

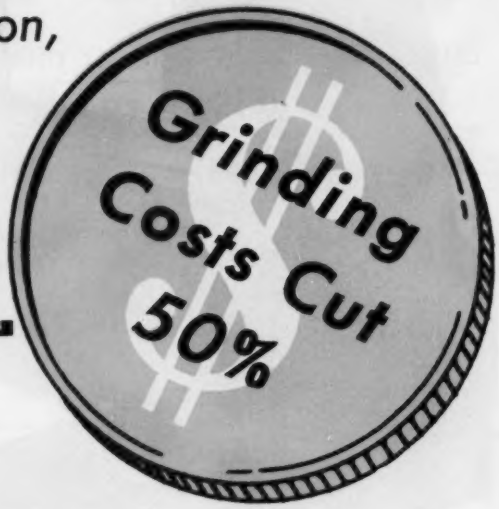




IN WISCONSIN MOTOR CORPORATION'S MILWAUKEE PLANT, crankshafts are ground on a Norton Type CTU-HD 10" semiautomatic heavy duty cylindrical grinder for approximately half what this job formerly cost. Diagram shows six simultaneous grinding operations: two diameters by wheel on left, three diameters and taper by wheel on right.

The "WISCONSIN STORY"...

Wisconsin Motor Corporation, leading manufacturers of heavy duty air-cooled engines, reports:



with this Norton Heavy Duty Grinder

Type CTU-HD machine in Milwaukee plant grinds crankshafts faster and better — at one-half previous cost!

Wisconsin Motor Corporation's endorsement of the Norton Type CTU-HD cylindrical grinder is echoed throughout industry. In plenty of other modern plants this highly advanced, heavy duty machine is doing an outstanding job of boosting production rates and profit margins.

A single 10" Type CTU-HD — or 14" Type LCTU-HD, with increased swing — replaces several separate old-type grinders. It accommodates multiple wheels widely spaced, making it ideal for many plunge cut operations. Or it will take large diameter wheels, essential on such jobs as grinding crankshaft bearings, in order to permit adequate wheel wear before interference with parts of the work.

Semiautomatic or Plain

The semiautomatic arrangement provides an adjustable, automatic grinding cycle under one-lever control. The operator merely loads and unloads, and so can handle more than one machine. Except for this feature the plain machine is identical, and both machines are arranged for fast traverse grinding.

Simplified Operation and Maintenance

All controls for feeds and speeds are set in front of machine. Wheel feed is by a precise revolving screw mechanism with click-count index, by which settings for .0001" in work diameter reduction can be made instantly, without visual check. Controls of work rotation and coolant flow are automatic. Pumps, motors, filters, relief valves, ways lubricant control valves are all outside, for easy maintenance.

For Complete Details

see your Norton Representative or write us direct. And remember: only Norton offers you such long experience in both grinding machines and wheels — your assurance of the "Touch of Gold" that helps you produce more at lower cost. NORTON COMPANY, Machine Division, Worcester 6, Mass. *In Canada:* J. H. Ryder Machinery Co., Ltd., Toronto 5.

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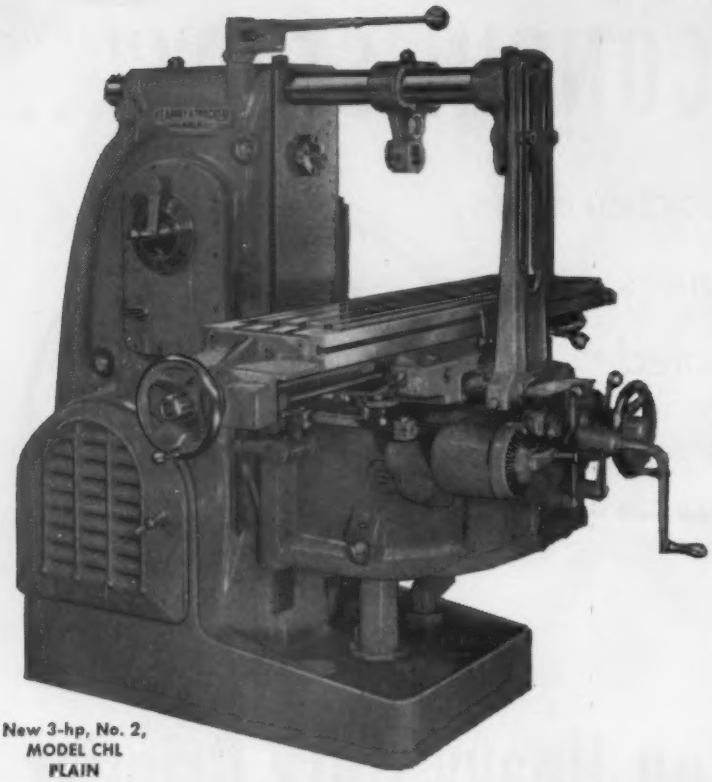


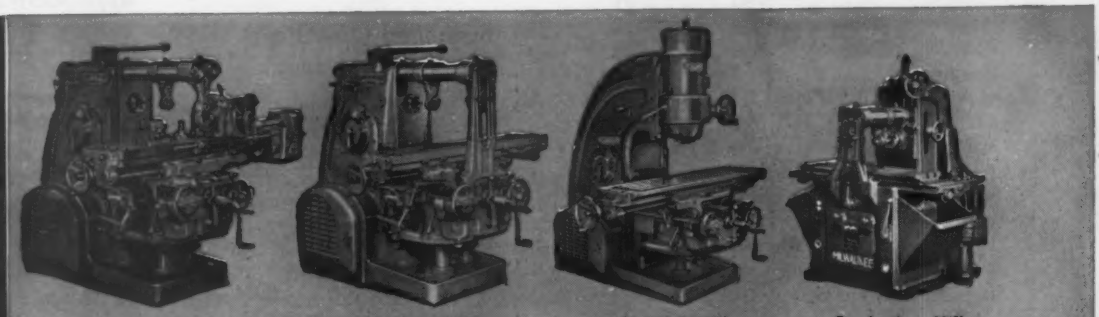
New 3-hp, No. 2, MODEL CHL PLAIN

...will put this new 3-hp, No. 2, Model CHL plain milling machine to work in your plant with...

Kearney & Trecker's

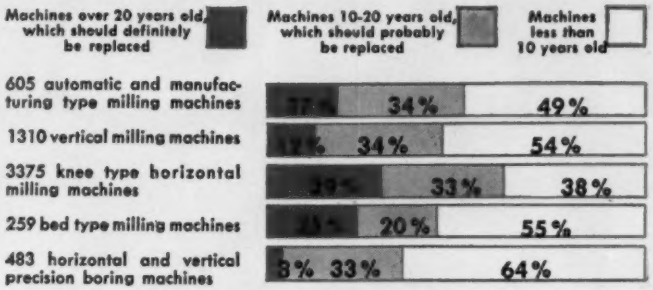
TOOL-LEASE PROGRAM

Kearney & Trecker manufactures a complete line of more than 250 standard knee and bed type milling machines and precision boring machines.



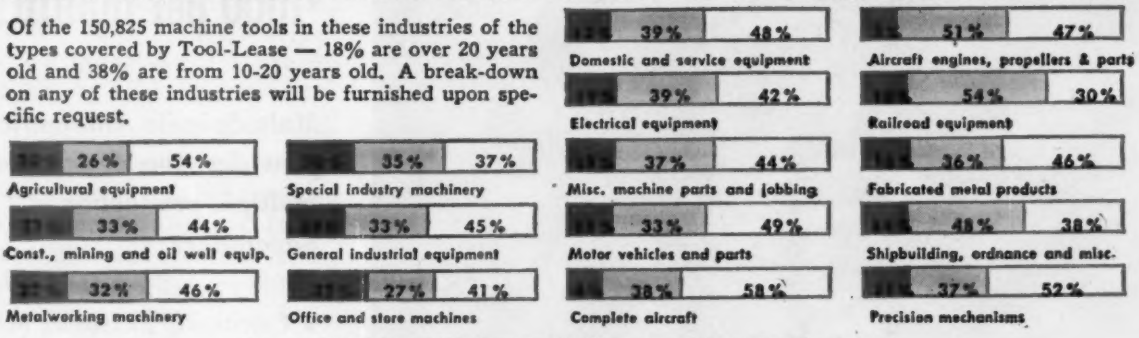
LET'S LOOK AT THE OBSOLESCENCE PICTURE IN THE GENERAL INDUSTRIAL EQUIPMENT INDUSTRY

Here's the picture in a typical industry — GENERAL INDUSTRIAL EQUIPMENT — (see chart at right). Of the 6032 standard knee type horizontal, vertical, bed and manufacturing type milling machines and precision boring machines in use today — which can be replaced by Tool-Lease equipment — 22% are more than 20 years old, 33% are 10 to 20 years old, 55% are more than 10 years old!



HERE'S THE OVERALL PICTURE IN THE ABOVE AND 15 OTHER BASIC INDUSTRIES

Of the 150,825 machine tools in these industries of the types covered by Tool-Lease — 18% are over 20 years old and 38% are from 10-20 years old. A break-down on any of these industries will be furnished upon specific request.



Figures adapted from 1953 American Machinist survey of metalworking industry

NO! We didn't make a mistake. Under Tool-Lease Plan "A", one of three seven-year lease agreements offered by Kearney & Trecker, you are asked to make two semi-annual rental payments, totaling 25% of the machine's price during each of the first three years. Actually, in dollars and cents, you are asked to invest approximately 23 cents per hour for a new 3-hp, No. 2, Model CHL plain milling machine. That means a machine installed in your plant and in operation — *for pennies an hour!*

What's more, under Tool-Lease, you can rent any of over 250 standard milling machines or precision boring machines. All are available under three basic plans, with varying options to continue or terminate the lease, or to purchase the equipment. If you require special machinery or heavy-duty CSM bed types, special agreements will be considered.

GET ALL THE FACTS NOW!

For complete information on Tool-Lease . . . help in analyzing your milling and/or precision boring needs — see your Kearney & Trecker representative or mail coupon to Kearney & Trecker Corp., 6784 W. National Avenue, Milwaukee 14, Wisconsin.

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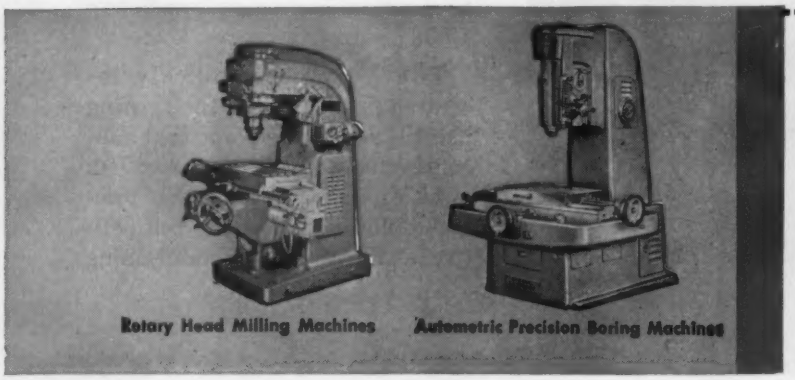


KEARNEY & TRECKER CORP.
6784 W. National Avenue
Milwaukee 14, Wisconsin

Please send me Bulletin TL-10A on Tool-Lease Program and booklet titled "Critical Picture of Creeping Obsolescence" or call Milwaukee, GReenfield 6-8300.

Name.....

Title.....

Company.....

Address.....

City..... Zone..... State.....

Direct labor savings from Warner & Swasey Automatic: $1000 per month!

Multi-Spindle Automatic provides American Sterilizer multiple production advantages

• Constantly increasing business, plus schedule-disrupting "peak" production periods created by government orders, indicated the need for more productive turning equipment at American Sterilizer Company in Erie, Pennsylvania. Production of precision parts for their complete line of hospital equipment exceeded the capacity of the battery of turret lathes in the plant. And subcontracting work had not proved a wholly satisfactory answer to the problem.

A Warner & Swasey 5-Spindle Automatic Bar Machine was added to their turret lathe department to meet the situation. This machine's short setup features ideally suited their wide variety, comparatively small lot production, generally ranging from 500 to 1,500 pieces.

The Automatic quickly increased production in the existing plant space to the point that subcontracted work could be recalled. It also reduced costs so that pricing could be made more competitive, at the same time maintaining

YOU CAN PRODUCE IT BETTER, FASTER, FOR LESS...WITH A

the high quality standards of American Sterilizer.

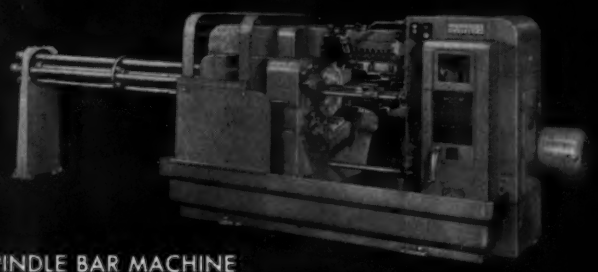
Since its installation in 1953, direct labor savings from the Automatic have averaged more than $1,000 per month. And, more recently, "break-even" calculations determined that smaller lot work could be profitably run on the Automatic, so that now more and more jobs are scheduled for the machine. As a result, current monthly labor savings are up to $1,500.

Besides increasing production for American Sterilizer this Warner & Swasey Automatic has provided many other advantages. Its 12 work stations and ability to repeat accurate settings have permitted combining operations, thus limiting previously-required secondary operations as well as eliminating some preliminary sawing operations.

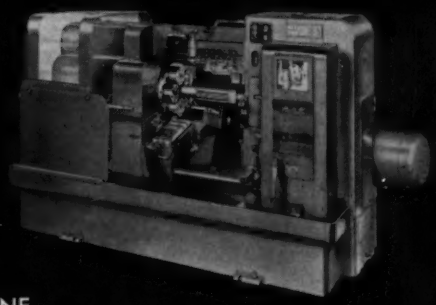
Accuracies of plus or minus .001" are constantly maintained, producing more uniform, higher quality work at less cost. The machine's rigidity and consistent feeding pressures have contributed to substantially longer tool life. Overhead has also been decreased, and overtime eliminated.

This story once again proves that Warner & Swasey Automatics do "fit" into a turret lathe department—that they can handle many jobs normally considered strictly turret lathe work, and do them faster, at less cost. An evaluation of the work in your plant will probably show a number of jobs that could be machined more profitably on a Warner & Swasey Automatic. Our Field Engineer will be glad to help you analyze your jobs and recommend the right machine to fill your production requirements most efficiently.

MULTI-SPINDLE AUTOMATICS



5-SPINDLE BAR MACHINE
1¾" Standard Bar Capacity
2¼" Oversize Capacity



5-SPINDLE
CHUCKING MACHINE
6" Swing

6-SPINDLE BAR MACHINE
¾" or 1¼" Bar Capacity

75TH ANNIVERSARY YEAR
WARNER & SWASEY
Cleveland
PRECISION MACHINERY
1880 — 1955

WARNER & SWASEY

"Talk about AUTOMATION there's a living example FRANCHISED

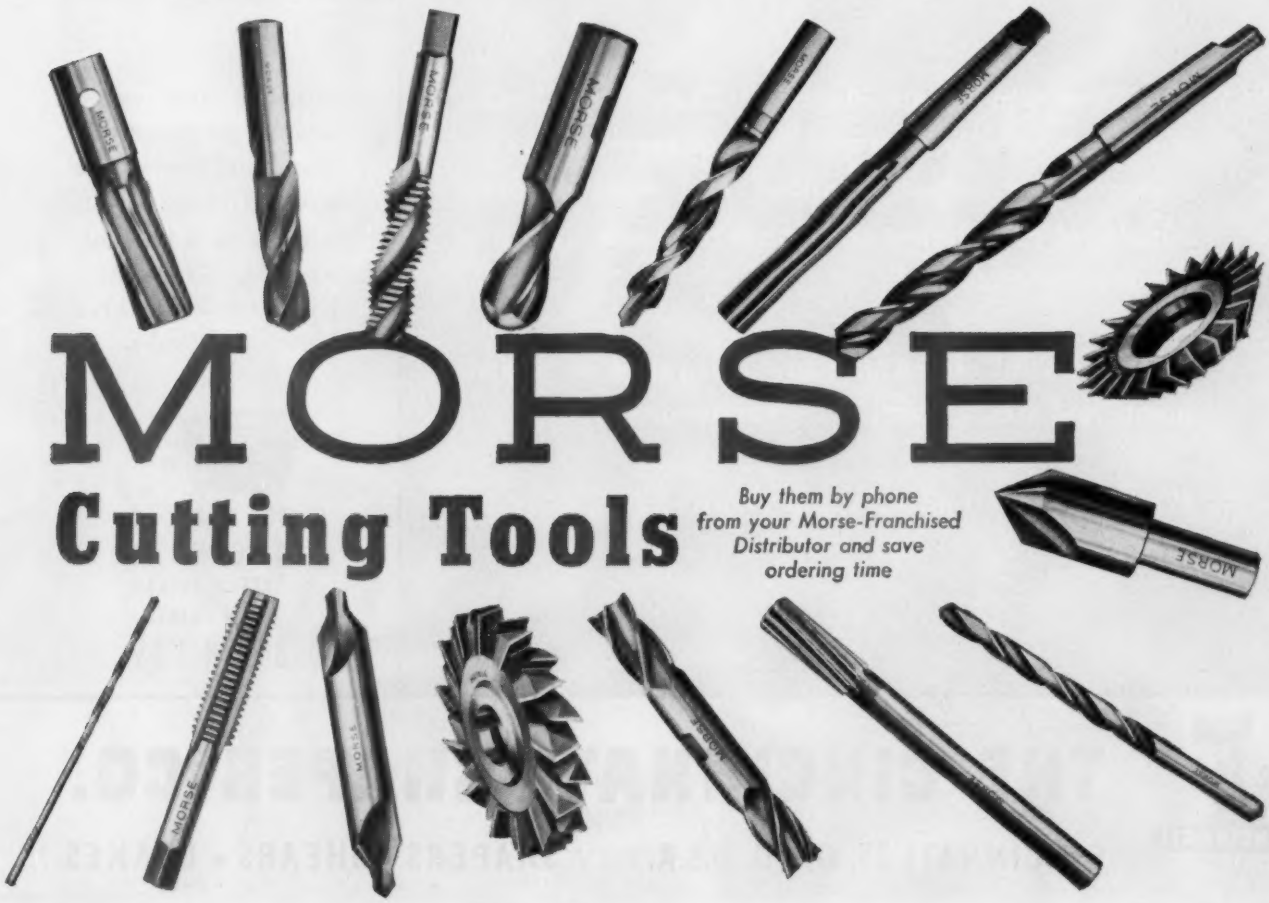
! ...my MORSE-DISTRIBUTOR"

That's right! Every Morse-Franchised Distributor knows his customers' needs so well that he keeps supplied . . . *automatically* . . . with all the Morse Cutting Tools regularly required. And if emergencies arise, he answers your call before real trouble has time to set in.

Back of him is the full Morse line . . . proved by surveys to be the full line with top acceptance in its field today. And he can give you Morse Tools plain or Electrolized . . . plus the exclusive new "Vectormatic" Ground Taps that give you more holes per dollar than you ever got before.

Yes, you can rely on the 24-hour-a-day responsibility of your Morse Franchised Distributor to keep your production up and your costs down. *Call him now while you're thinking of it.*

MORSE TWIST DRILL & MACHINE COMPANY
NEW BEDFORD, MASSACHUSETTS
(Division of VAN NORMAN CO.)
Warehouses in New York, Chicago, Detroit, Dallas, San Francisco



Outstanding Time Saver...

The New Cincinnati Electro-Magnetic Clutch and Brake alone brought a 30% time-saving here

The New Cincinnati Magnetic Clutch and Brake, with its single, convenient control lever, gives the operator the fastest, simplest and most accurate control of his Shaper and converts waste time into productive time.

This powerful clutch and brake requires no adjustment, and has a long, maintenance-free life.

Write for Cincinnati Shaper Catalog N-6.

Shaping time on 7 internal oil grooves in these steel sleeves was reduced from 12.5 minutes to 8 minutes, by the Cincinnati Electro-Magnetic Clutch and Brake.

SEE
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SHAPERS, SHEARS,
PRESS BRAKES
BOOTH 1105

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THE CINCINNATI SHAPER CO.

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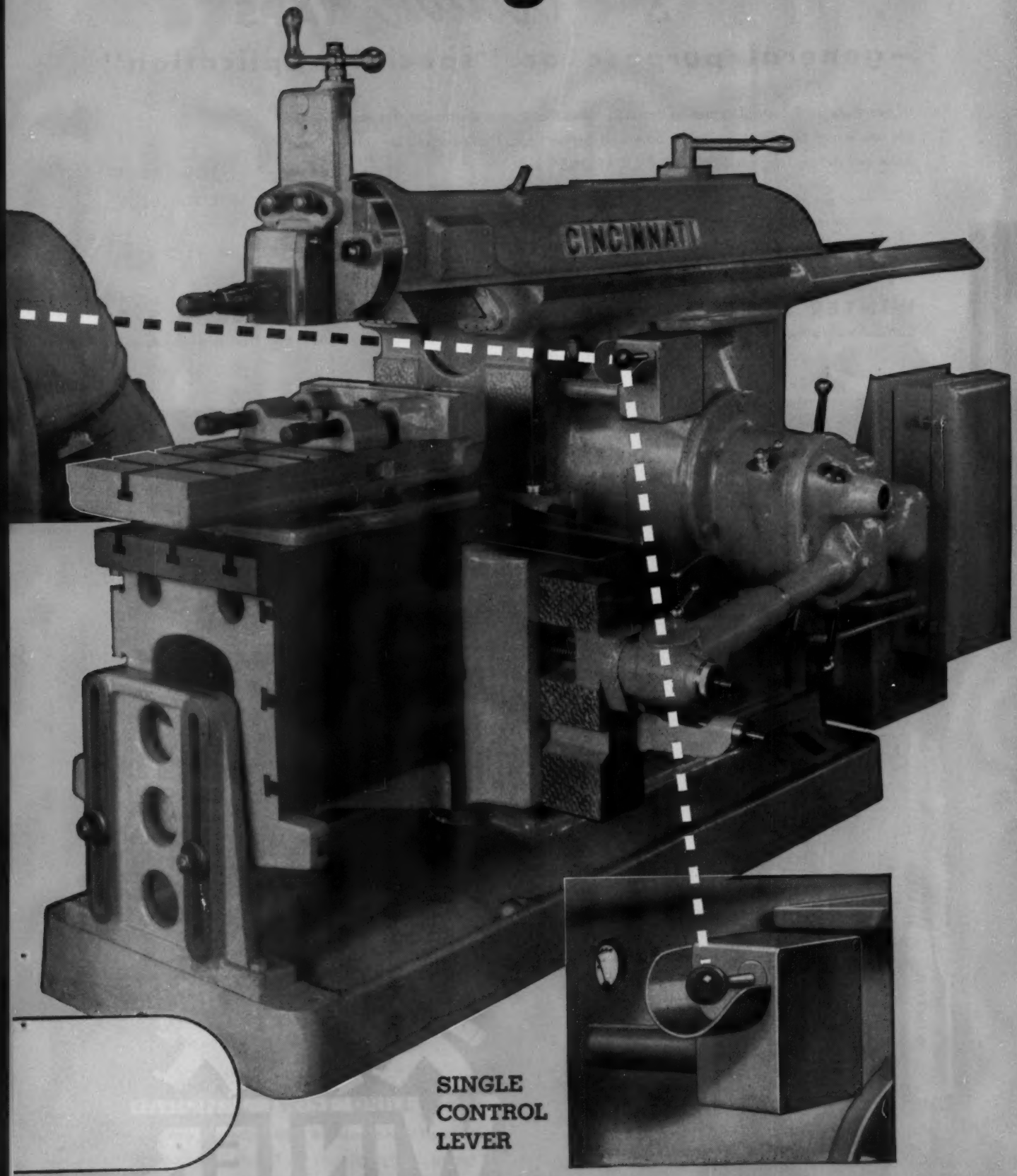
...Outstanding ACCURACY



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Painstaking care by the cutting tool manufacturer in design, processing, and metallurgy makes good cutting edges. With reasonable care by your operator, good cutting edges *stay good* . . . You can rely on National tools to *make good* in stamina and long life.

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at the Show
Booth No. 1402

the Moore-Fosdick

The only machine of its kind in

• Greater range—22" x 42" x 27" height • Automatically positions work to ±.0001"

• Grinds jigs, dies, punches, templates and machine parts • Infinite Grinding Speeds—12,000 to 60,000 rpm • Contour and Chop Grinding • Slot Grinding Attachment • Spindle-Housing Heat Control

This new machine combines the unique Moore Jig Grinding Head with the exclusive Fosdick Automatic Positioning Table. It gives you greater capacity for precision grinding with the speed and convenience of a table that automatically positions work to ± .0001". *There is no other machine in the world that even approaches the Moore-Fosdick in jig-grinding capacity, versatility, convenience and precision!*

Grinds Cylindrical and Tapered Holes. The Moore-Fosdick allows you to grind cylindrical as well as conical holes, with taper in either direction. An angular and indexing device built into the main spindle, and the newly developed slot grinding attachment, permit the quick, accurate grinding of any contour—*regular* or *irregular*.

Large Work Capacity—Infinite Number of Speeds. The Moore-Fosdick A. P. Jig Grinder has an infinite range of grinding speeds – from 12,000 to 60,000 rpm . . . allowing extreme versatility and accurate control of grinding and stock removal. Larger table size and greater work height, coupled with greater power, *extend* the overall range of precision grinding operations.

SPECIFICATIONS

Capacity:	No. 30-G	No. 42-G & No. 42-PG*
Table size	36"x18"	44"x22"
Table travel, Longitudinal	30"	42"
Table travel, Crosswise	17½"	22"
Table top to wheel collet	2" to 27"	2" to 27"
Spindle to column ways	18½"	18½"
Spindle to column below ways	20"	25¼"

Four spindle speeds: 90, 120, 180, 240

Spindle feeds by air-powered hydraulic control—infinite speed control

Grinding speeds: 12,000 to 60,000 rpm; 3 heads

Grinding Capacity:
With grinding wheels, 3/16" to 5" (8" with adapter)
With diamond mandrels 1/64" to 3/16"

Travel main spindle slide... 3⅛"

Angular adjustment of spindle up to 1½° either way or 3° included angle.

Radial offset of grinding spindle-from center to 1⅛" off center by rough adjustment-while running 0.0001" adjustment for distance of 0.075" anywhere in the 1⅛" range.

Weights and Floor Space:	No. 30-G	No. 42-G & No. 42-PG
Machine with regular equipment, including motor	6000 lbs.	11,000 lbs.
Shipping weight	6750 lbs.	12,000 lbs.
Floor space	77"x82"	102"x128"

Standard Equipment:
Four-speed constant torque ¼ hp motor, 220-440 volts, 50-60 cycles, 2-3 phase, wheel dresser—micrometer stop-wrenches. Two built-in locating devices: two 1" .0001 inside micrometers; two 1", 2", 3", 4", 5", 10" and one 15" end measurers in box.

Compressed Air Requirements:
90 to 100 lbs. @ 15 cfm, furnished by customer. We recommend a heavy-duty 7.5 hp air compressor with a water aftercooler, provided it is capable of this output.

*42-PG Moore-Fosdick Jig Grinder with Automatic Positioning.

Write today
for price and delivery information.

Jig Grinder

the world!

Grinding Wheel Outfeed, Reads .0001", Adjustable while running
Cross Power Traverse Safety Switch and Positioning Control
Vertical Slide Taper Setting
Positive Adjustable Depth Stop, Micro Setting
Depth Measuring Dial Reads to .001"
Heating Elements for Continuous Temperature Control of Spindle Housing
Grinding Wheel Outfeed Slide, Course Adjustment
Longitudinal Power Traverse Safety Switch and Positioning Control
Measuring Rods or Duplicating Bars
Push Buttons to Control Table and Slide Rapid Traverse and Positioning of Table and Slide
MOORE-FOSDICK

Positions Work Automatically to ± .0001". With the Automatic Positioning Table, you can get fast and accurate positioning of parts to be ground. Two simple duplicating bars may be prepared to position work automatically to ± .0001" — at the touch of a pushbutton. This means that complex grinding jobs with hundreds of holes require only one set-up. On "one-time" jobs, measuring rods can be used in place of bars. For precision production jobs, the easily-made, easily-stored duplicating bars give you a permanent record of positions. Once a job is run, you store the bars and use them every time you rerun that same job — weeks, months or years later.

Grinder Head Dimensional Stability. Latest design of the grinding head incorporates new features to improve further its stability. These include: (1) Electric heating elements in the main spindle housing to maintain uniform temperature whether machine is running or not; (2) An observation thermometer so located as to indicate any temperature change within the housing; (3) The housing itself is cast from 36% nickel iron to reduce the effect of any possible temperature variation to an irreducible minimum.

Need Drilling Equipment? Get a Proposal from Fosdick!

Radial Drills

Jig Borers

Sensitive and Upright Drills

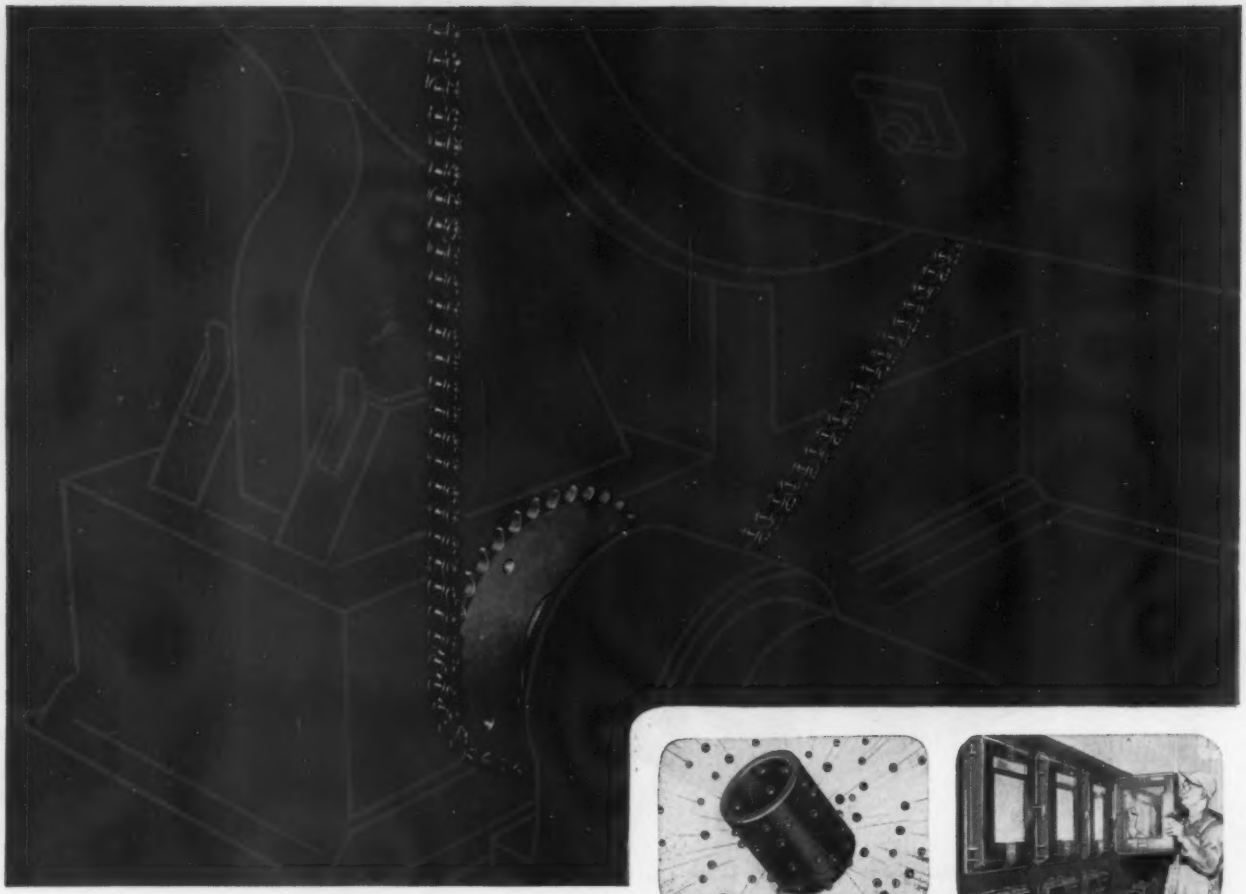
Sensitive Radial Drills

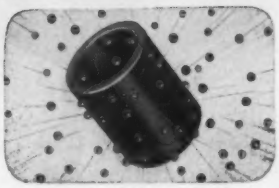
Automatic Positioning Machines

FOSDICK

THE FOSDICK MACHINE TOOL CO., CINCINNATI 23, OHIO

How these EXTRAS* make roller chain last longer

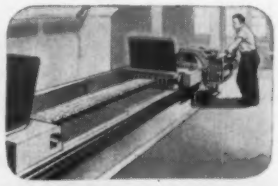




SHOT-PEENED ROLLERS have greater fatigue life, added ability to withstand impact.

CLOSER HEAT-TREAT CONTROL — coupled with rigid testing insures uniformity.

LOCK-TYPE BUSHINGS (applied on a range of sizes) end a cause of stiff chain.



PRE-STRESSING of multiple width chain provides uniform load distribution.

*And you pay no premium for these LINK-BELT extras

THERE'S more to roller chain than just the parts you see. *Much more!* It's the hidden extras—standard on Link-Belt Precision Steel Roller Chain—that add up to longer life and lower costs.

Check the four extras shown here. Then for your demanding drive and conveying jobs, choose from the complete line of Link-Belt roller chains and sprockets: Single or multiple widths, ¼″ through 3″ pitch. Double pitch, 1″ through 3″. There's full ordering and application information in 148-page Data Book 2457. Ask your Link-Belt office or distributor for a copy today.

LINK-BELT

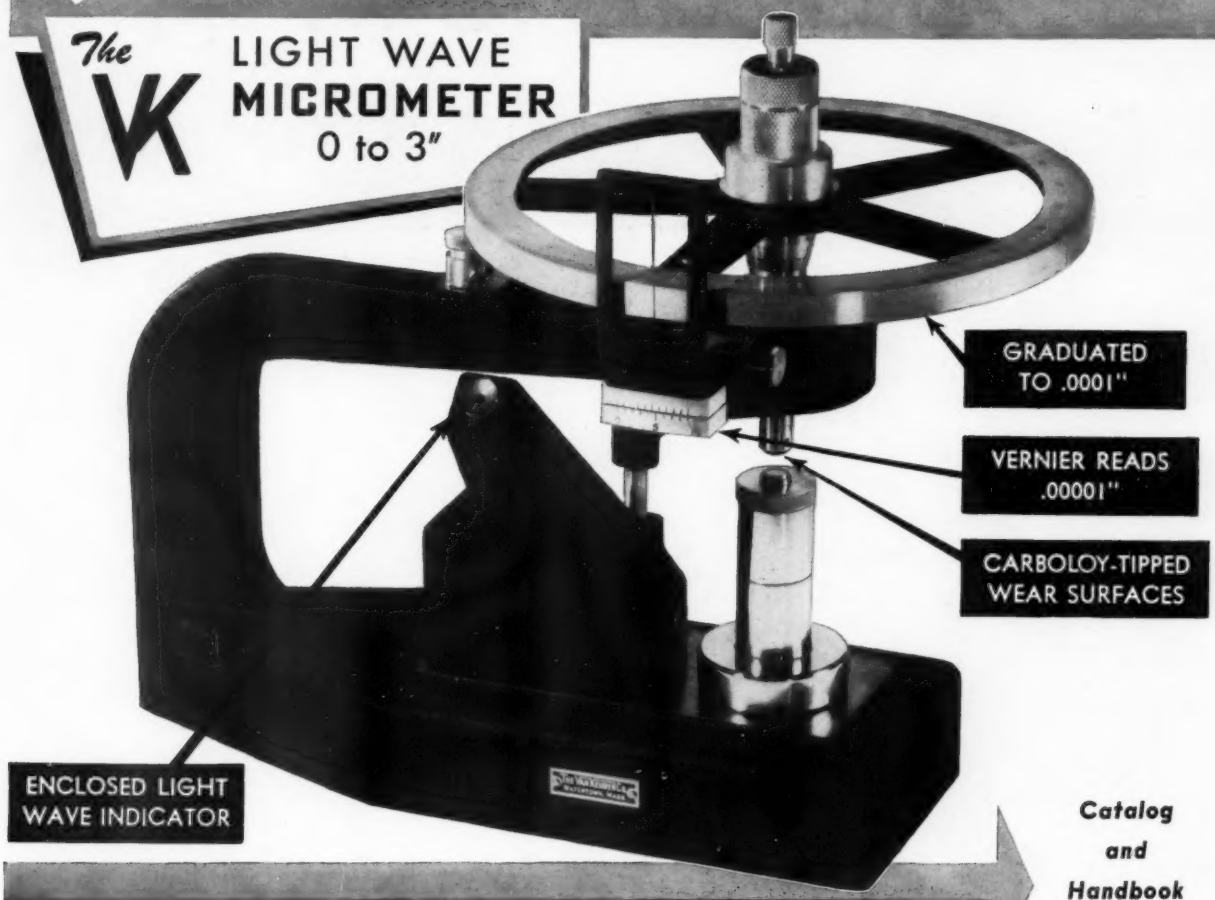
ROLLER CHAIN & SPROCKETS

13,000

LINK-BELT COMPANY: Executive Offices, 307 N. Michigan Ave., Chicago 1. To Serve Industry There Are Link-Belt Plants, Sales Offices, Stock Carrying Factory Branch Stores and Distributors in All Principal Cities. Export Office: New York 7; Canada, Scarboro (Toronto 13); Australia, Marrickville, N.S.W.; South Africa, Springs. Representatives Throughout the World.

for that last hundred-thousandth

The VK LIGHT WAVE MICROMETER 0 to 3"



The Van Keuren Light Wave Micrometer is an instrument of exceptional accuracy, ideal for measuring plug gages or small precision parts. Use it when you're after "that last hundred thousandth" involved in so many of today's measurements. The 0 to 3" instrument shown above has a ½" diameter, 40 threads per inch micrometer screw, which can be made with greater accuracy, and which has 3 times the wearing surface of an ordinary micrometer screw. It has an 8" diameter micrometer wheel, with .0001" graduations 1/10" apart. It has a non-parallax vernier index which enables readings to be made to .00001". It has an index lock and carboloy-tipped anvil and spindle. This sturdy, sensitive instrument weighs only 17 pounds, and is in reality a portable measuring machine of inbuilt and sustained accuracy.

The Light Wave Micrometer is not a comparator. No gage blocks are needed and no errors creep in from worn blocks. It is a direct source of dependable precision . . . fast, accurate and profitable.

Catalog and Handbook No. 35

This 220-page volume represents years of research by the Van Keuren Co. It presents a simple and exact method of measuring screws and worms with wires, tells how to measure gears, splines and involute serrations. It is on accepted reference book for measuring problems and methods. Ask for your copy . . . sent free on request by writing: The Van Keuren Company, 173 Waltham St., Watertown, Mass.

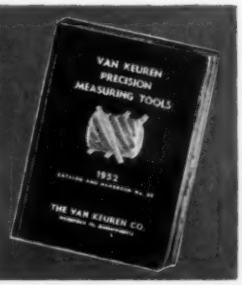
VK

36th YEAR

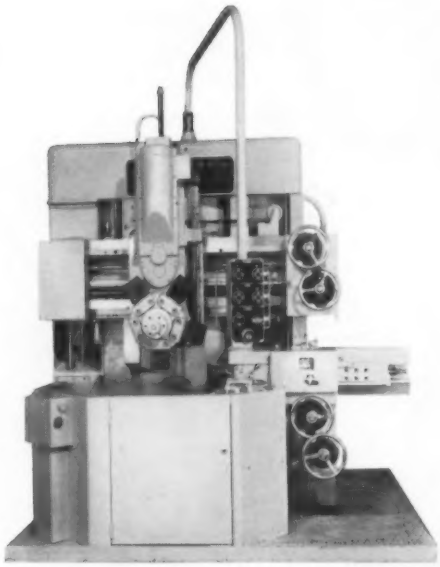
THE *Van Keuren* CO.

173 WALTHAM STREET, WATERTOWN, MASS.

Light Wave Equipment • Light Wave Micrometers • Gage Blocks • Taper Insert Plug Gages • Wire Type Plug Gages • Measuring Wires • Thread Measuring Wires • Gear Measuring System • Shop Triangles • Carboloy Cemented Carbide Plug Gages • Carboloy Cemented Carbide Measuring Wires • Chrome Carbide Taper Insert Plug Gages

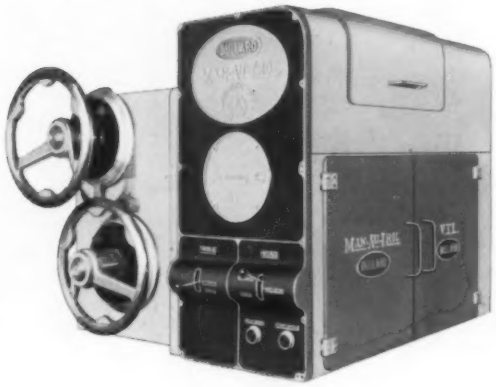


Machine Tools for *Today*..



The most versatile vertical turret lathe available to the metalworking industry

Man-Au-Trol, Model 75 . . .



Versatile because at the time of purchase should your production output require only a Cut Master V. T. L., Model 75 and later increase so that automatic operation is desirable, a Man-Au-Trol Conversion Unit can be added to the Cut Master right in your plant.

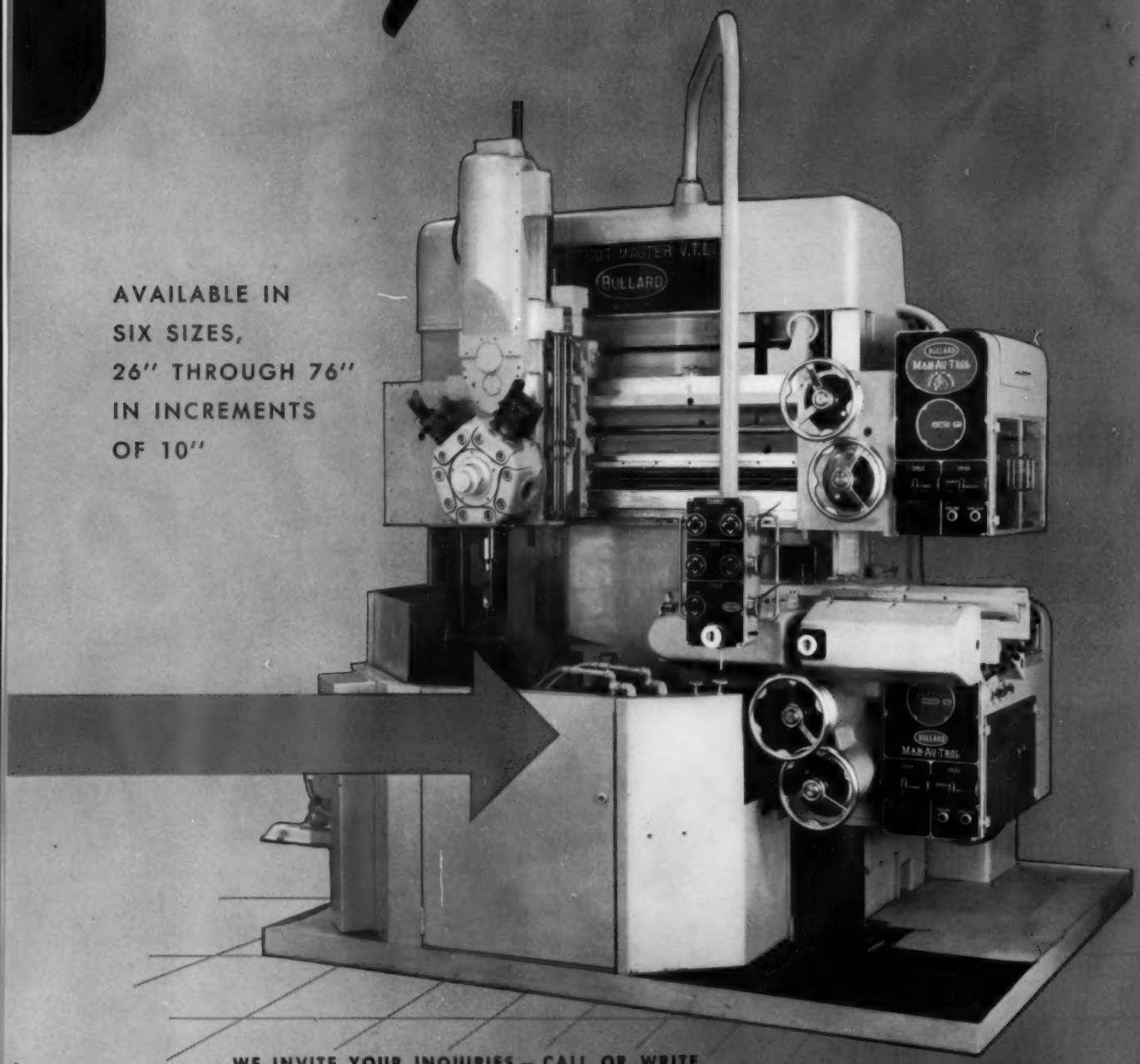
The Man-Au-Trol Conversion Unit directs the machine through all the functions the machine is capable of performing—automatically—by use of control and function drums. Machine down time for job change-over is reduced to a minimum since the control drum can be pre-set in advance and placed in the machine in a matter of seconds.

Your Bullard Sales Engineer will be glad to fully explain all of the technological advantages that are incorporated in the Man-Au-Trol, Model 75 and apply them to your machining problems.

THE MACHINE TOOL SHOW
CHICAGO, ILL.
SEPT. 6-17, 1955
INTERNATIONAL AMPHITHEATRE

PLAN TO VISIT OUR EXHIBIT AT BOOTH 1213

. . and *Tomorrow!*



AVAILABLE IN
SIX SIZES,
26" THROUGH 76"
IN INCREMENTS
OF 10"

WE INVITE YOUR INQUIRIES — CALL OR WRITE
YOUR NEAREST BULLARD SALES OFFICE, DISTRIBUTOR OR . . .

SEVENTY FIFTH
1880 BULLARD 1955
ANNIVERSARY

The Bullard Co.

Bridgeport 2, Connecticut

ARMSTRONG

Use the Correct...

ARMSTRONG TOOL HOLDERS

to increase pieces, production and profits!

Because they do their work so well, without repairs, maintenance or replacement . . . because they last for years and have become as much a part of everyday operations as steel itself, the importance of using the correct type and size ARMSTRONG TOOL HOLDER for each operation, is frequently overlooked. It should always be remembered that by controlling the cutting point, ARMSTRONG TOOLS control both the productivity and efficiency of every lathe, planer, slotter, and shaper in most shops.

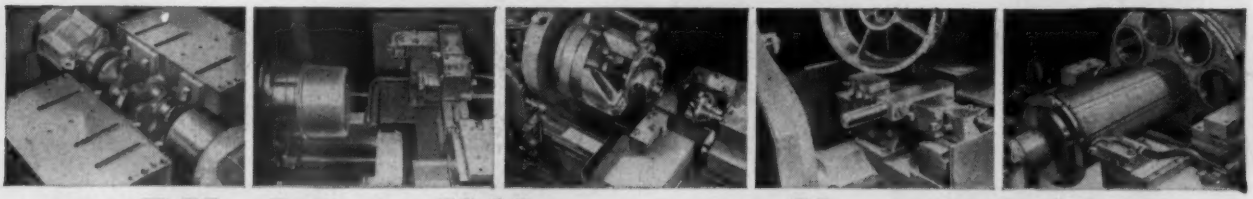
Tools so vitally situated, no matter how trouble-free, deserve periodic checking . . . checking to see that the correct size and correct type ARMSTRONG TOOL HOLDER is being used for each operation: checking to be sure that you are taking full advantage of the new additions to the Armstrong System—the special types for ARMIDE (Carbide Tipped) Cutters, others for ARMOLOY (Cast Alloy) Bits and Blades; the newer "spring" form threading tools and cutting-off, etc., etc.

Write for a recent ARMSTRONG Catalog and check your tooling of each operation.

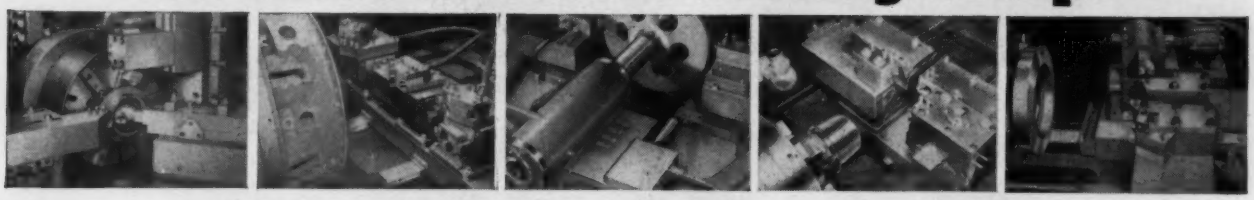
ARMSTRONG BROS. TOOL CO.

"THE TOOL HOLDER PEOPLE"

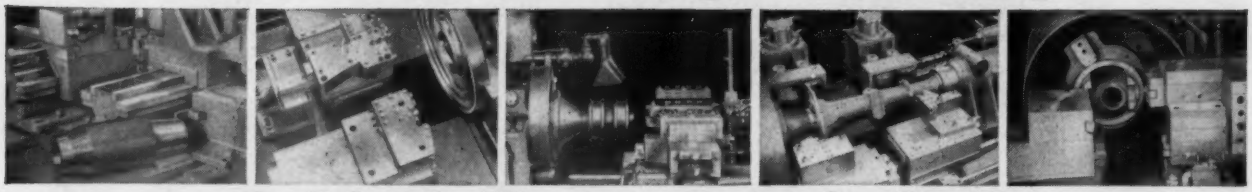
5215 W. ARMSTRONG AVE. **CHICAGO 30, ILL.**



All these different tooling setups



show the amazing versatility



# of this fully automatic lathe

...the SIMPLIMATIC

Here's versatility that beats any automatic lathe you ever saw! Actually, the Simplimatic is doing hundreds of jobs like these—jobs that would otherwise be put on *special* machines—built at extra-special cost. But this (and don't miss the important point!) is a *standard machine*—at a *standard price.*

If you have medium or long runs on parts up to 3 3½" in diameter, get the facts about the Simplimatic Automatic Lathe.

GISHOLT MACHINE COMPANY

Madison 10, Wisconsin

TURRET LATHES • AUTOMATIC LATHES
SUPERFINISHERS • BALANCERS • SPECIAL MACHINES

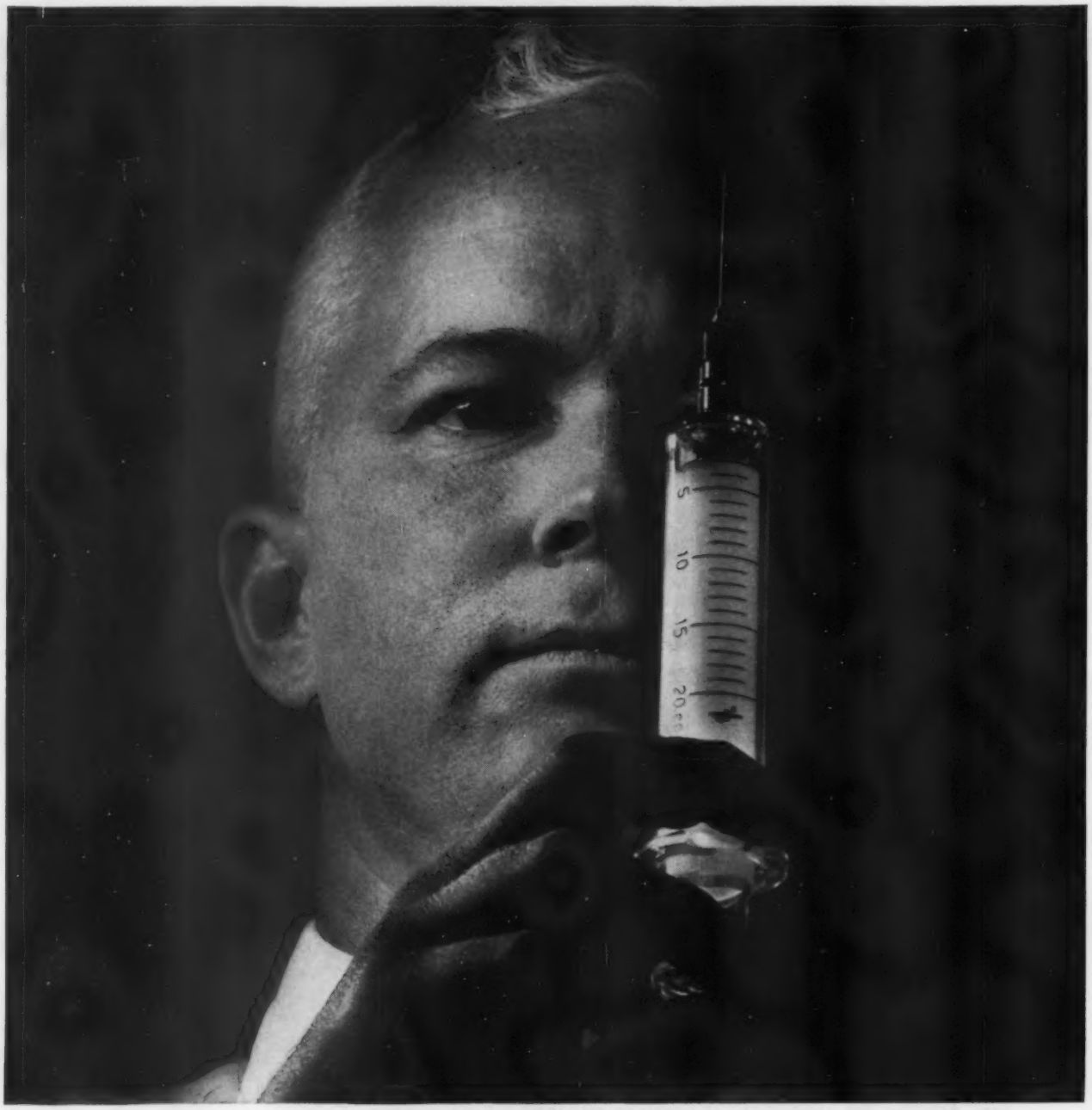
THE GISHOLT ROUND TABLE

represents the collective experience of specialists in the machining, surface-finishing and balancing of round and partly round parts. Your problems are welcomed here.

THIS CATALOG may show you how the Simplimatic can save thousands of dollars for you as it is doing for many others. Write for your copy.

Gisholt Machine Co.
Madison 10, Wisconsin
Gentlemen:
Please send my copy of the Simplimatic Catalog.

Name.....*Title*.....
Company.....
Address.....
City.....*Zone*....*State*.....



Henry P. Becton, Executive Vice-President of Becton, Dickinson and Company, explains

"Why a doctor must never be rushed!"

"A famous surgeon used to say to his young student doctors, 'A man with a severed carotid artery will bleed to death in three minutes. You can sew it up in two-and-a-half minutes — *if you're not in a hurry.*'

"Everyone who serves the medical profession must know how to be quick and sure. That's why Air Express is important to us at B-D. Our customers *must* be sure they can depend on us.

"A vaccination program, or a flood, fire or explosion can mean immediate need for hypodermic syringes and needles, elastic bandages, blood donor equipment. Air Express is the sure way to get it there.

"Air Express can save you money, too. A 20-lb. shipment from Rutherford, N. J., to Des Moines, Ia., for instance, is $8.12. That's the lowest-priced complete service by $1.48!"

Air Express

GETS THERE FIRST *via U.S. Scheduled Airlines*

CALL AIR EXPRESS . . . *division of* RAILWAY EXPRESS AGENCY

Morgan Engineering Co. now gets full efficiency from high-speed planer as...

Carboloy Grade 370 carbide cuts production time 50% on steel-cutting "problem" job

Here's still more proof that there are no known "equivalent grades" for Carboloy® Series 300 carbides for medium- and heavy-duty steel-cutting:

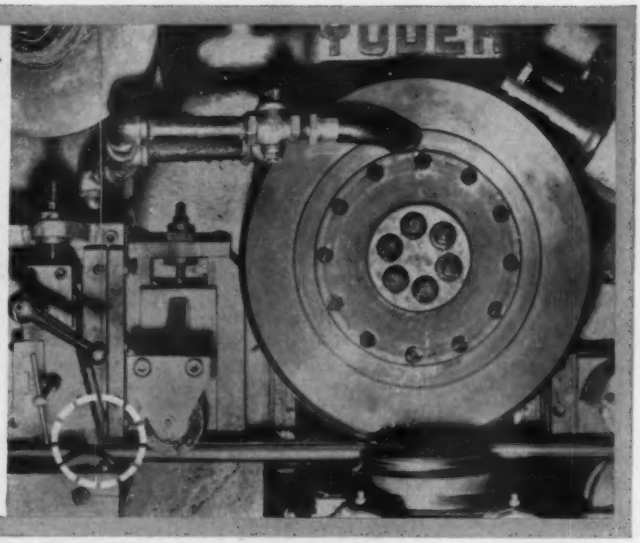
PLANING CAST STEEL GEAR CASE. Long planer cuts on this 1-ton cast steel gear case cause thermal cracking in any carbide. Former tools had to be "babied along" to prevent excessive downtime for tool changes. Switching to Carboloy Grade 370, Morgan Engineering Co. now runs their high-speed planer four times faster . . . removing nearly 2000 cubic inches of metal before regrinding to eliminate thermal cracks. Production and tool life are doubled; machine efficiency is up 15%.

SETUP: Material—1-ton cast steel forging. **Speed**—160-180 SFPM. **Feed**—0.040-0.080 inch. **Depth of cut**—$\frac{5}{16}$-$\frac{1}{2}$ inch. **Coolant**—No.

Carboloy Grades 350 and 370 increase machine output, lower tool costs. Here's the complete story . . .

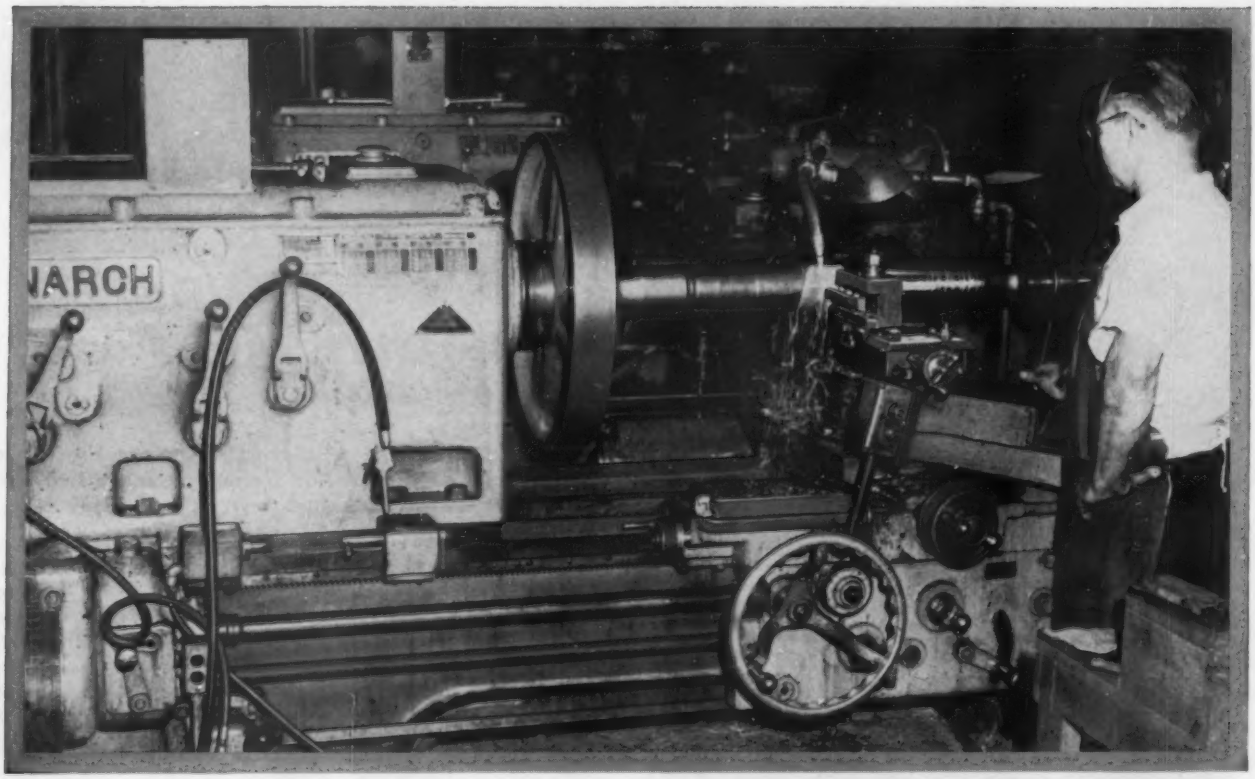
FLASH TRIMMING steel tubing at 2400°F ruined tools quickly at Bissell Carpet Sweeper Co., Grand Rapids, Mich. Switching to a standard Grade 370 tool eliminated costly special carbide tool; boosted production 14%. Line now operates full day without tool change.

SETUP: **Material**—cold-rolled steel. **Speed**—50-60 SFPM. **Coolant**—No.



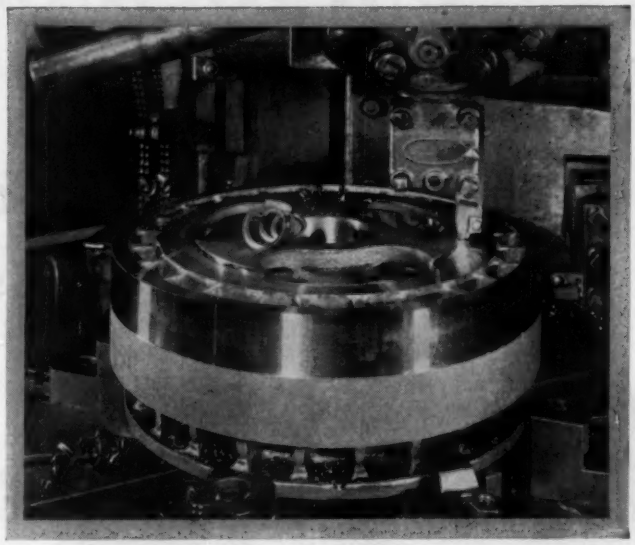
Case histories prove there are no known "equivalent grades"—

Carboloy 350 and 370 outperform



TURNING landing-gear piston with Grade 350 saved Menasco Mfg. Co., Burbank, Calif., ½ hour per shift in downtime. Other carbides produced 2 parts per grind at 125 SFPM; Grade 350 cuts at 185 SFPM with 6 times the production per grind.

SETUP: **Material**—4340 heat-treated forged steel. **Speed**—185 SFPM. **Feed**—0.010 inch. **Depth of cut**—0.060-0.200 inch. **Coolant**—Yes.



FACING power shovel clutch and brake drum assembly with Grade 370 inserts cut over-all machining costs almost 70% for a Chicago mining machine manufacturer. Two Grade 370 clamp-on blanks replaced 16 tools.

SETUP: Material—1045 low carbon, high manganese cast steel, with hardness of 27 R_c. **Speed**—24 RPM. **Feed**—0.018-0.033 inch. **Depth of cut**—⅜ inch. **Coolant**—No.

all other steel-cutting carbides

Boost production as much as 366%; reduce downtime losses, tool costs

Hundreds of metalworking plants are now using Carboloy Grades 350 and 370 on their toughest steel-cutting jobs. And from plant after plant come reports of:

Reduced production time because Carboloy Series 300 carbides maintain efficiency at faster speeds, greater feeds, deeper cuts.

Reduced downtime because these new grades can take the punishment of high-speed machining . . . and stay on the job.

Reduced tool costs because Grades 350 and 370 take more regrinds; often eliminate rough finishing operations and tools.

Increased machine efficiency because Series 300 carbides have the strength and versatility to let you operate machines at upper performance limits.

The new, carefully controlled Carboloy process used in producing Series 300 imparts built-in structural rigidity *at the cutting edge*. Both Grade 350 and 370 can operate efficiently around 1800°F . . . a range where the cutting edges of other carbides deform, greatly reducing their effectiveness.

Your Authorized Carboloy Distributor can give you immediate delivery on Carboloy standard tools, inserts, and blanks in Grades 350 and 370 . . . in a wide range of sizes and styles. For the new Series 300 price list GT-305, send coupon on the next page, today.

CARBOLOY
DEPARTMENT OF GENERAL ELECTRIC COMPANY

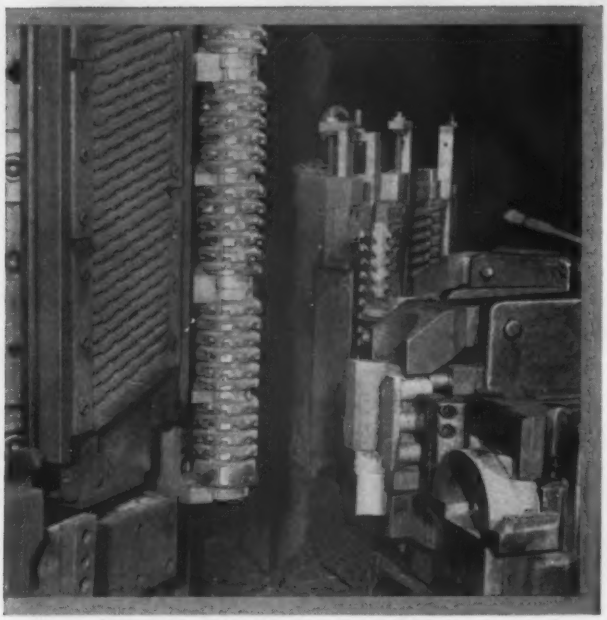
OVER→

Carboloy Created-Metals for Industrial Progress

impossible to machine long parts

If you're machining cast iron,
nonferrous metals, or plastics . . .

There's a Carboloy grade to fit your needs



BROACHING automobile bearing caps with Carboloy Grade 883 brought Studebaker a 22% saving in over-all costs. Carbide on previously used broach lasted a maximum of 24 hours; Grade 883 ran 50 days.

SETUP: Material—highly abrasive cast iron. **Speed**—28 SFPM. **Chip load per tooth**—0.005 inch for roughing; 0.0015 inch for finishing.

Carboloy tools, blanks, and inserts are available in many standard grades for machining cast iron, nonferrous materials, and plastics — as well as steel.

These grades are stocked in a wide range of sizes and styles by your Authorized Carboloy Distributor. He'll provide immediate local delivery to help you keep inventory costs down.

And your Distributor can give you expert assistance with any machining problem you may have . . . recommending the correct carbide grade and tooling method that best suits your particular job.

Send coupon, today, for price lists and specifications on Carboloy grades.

"Carboloy" is the trademark for products of the Carboloy Department of General Electric Company

CARBOLOY
DEPARTMENT OF GENERAL ELECTRIC COMPANY

MANUFACTURERS OF CEMENTED CARBIDES, PERMANENT MAGNETS, THERMISTORS, HEVIMET, AND VACUUM-MELTED METALS

CARBOLOY
Department of General Electric Company
11149 E. 8 Mile Road, Detroit 32, Michigan

☐ Please send price list and specifications on steel-cutting Grades 350 and 370.

☐ Please send price list and specifications on other standard grades.

Name_____ Title_____

Company_____

Address_____

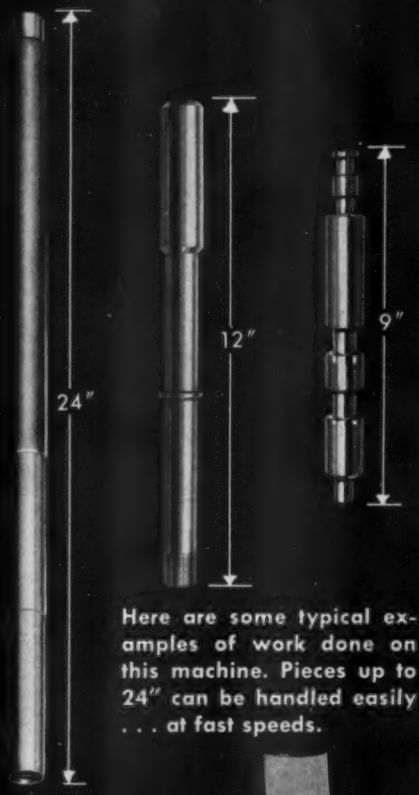
City_____ Zone____ State_____

AUTHORIZED CARBOLOY DISTRIBUTORS

See the Yellow Pages

. . . for the name of your local Authorized Carboloy Distributor. You'll find his name under the Carboloy trademark listing in classifications: TOOLS or TOOLMAKERS.

impossible to machine long parts AUTOMATICALLY on your present equipment?



Here are some typical examples of work done on this machine. Pieces up to 24″ can be handled easily . . . at fast speeds.

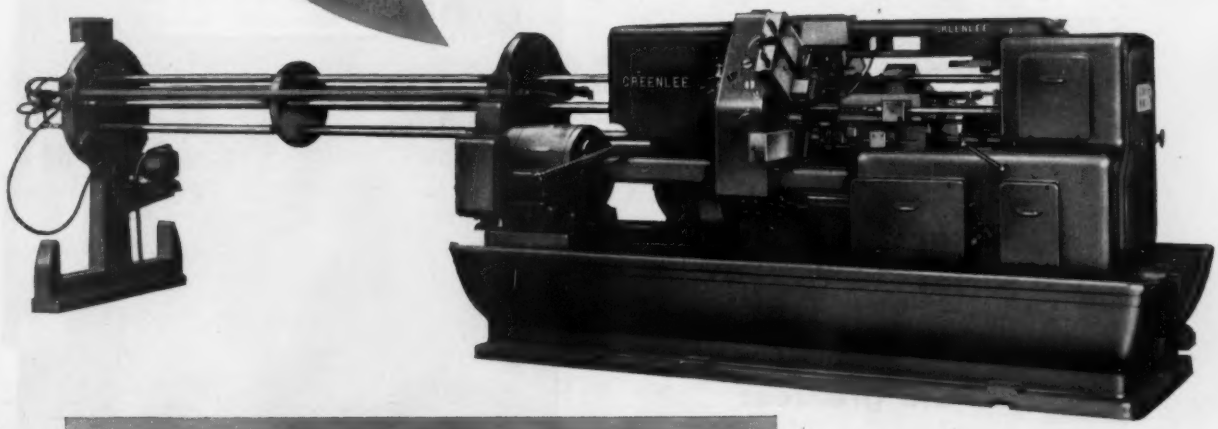
IT'S EASY... IT'S ECONOMICAL

with a GREENLEE SIX-SPINDLE BAR

AIR-FEED AUTOMATIC

This machine puts you in an enviable competitive position. Production goes up . . . costs go down. Check its many advantages: (1) Feeds out stock to 24″ (2) Has multiple feed-out (3) Eliminates stock scoring (4) Reduces stock reel noise (5) Eliminates stock pushers and feed-out cams. Especially worth noting is the fact that the stock can be fed out in one or more positions during either the index cycle or feed cycle.

Additional data will gladly be sent on request. Write today.



PRODUCTION MACHINERY
GREENLEE

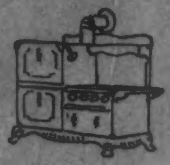
GREENLEE BROS. & CO.
1727 Mason Ave.
Rockford, Illinois

WRITE FOR COMPLETE INFORMATION

In the good old days

When the "Silver Campaign Depression" made it difficult to feed our horse, let alone meet the company payroll

when kitchen stoves were cast iron — and we made stove plate castings . . . when our first ads appeared in such well known magazines as:



HORSELESS AGE
AMERICAN MANUFACTURING
MODERN MACHINERY
THE GAS ENGINEER BULLETIN

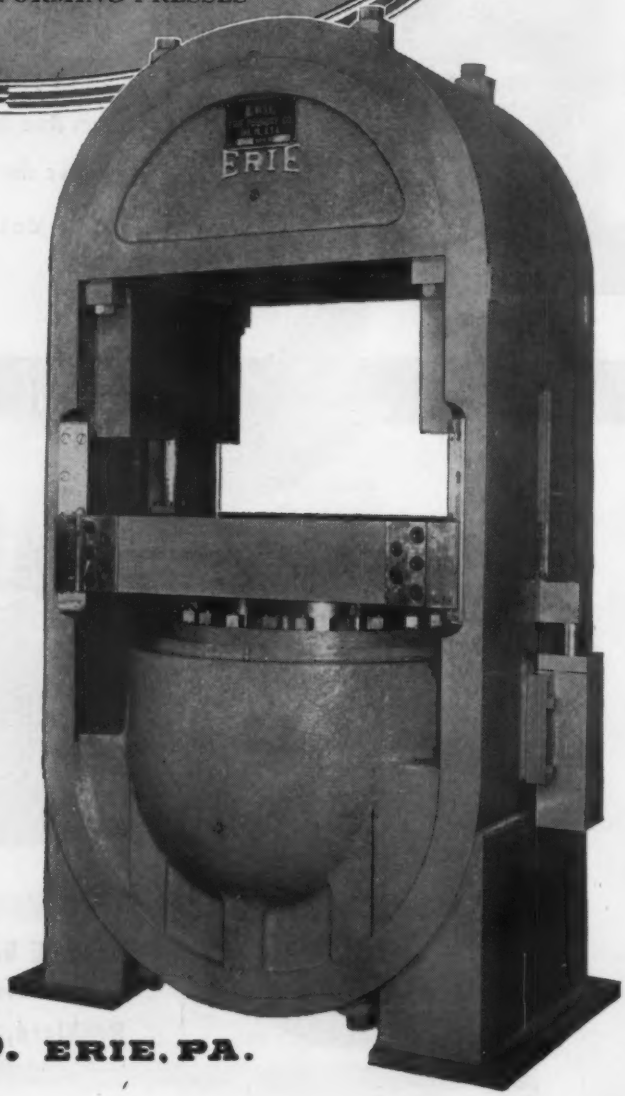
ERIE FOUNDRY WAS A GREAT NAME IN SPECIAL METAL-FORMING PRESSES

in today's modern metal working shop

When high labor costs mean more production per machine per hour to make a profit . . .

When exerting tremendous forces means faster shaping of metals . . .

When minimum deflection (less than .002") means almost perfect die matching . . . almost perfect parts . . .



ERIE

is still the greatest name in special hydraulic metal-forming presses

ERIE FOUNDRY CO. ERIE, PA.

MOTOR FACTS ON INDUSTRY'S

END MEASURING (LENGTH) RODS

Tolerance in millionths of an inch overall length.

1"	+ 8 — 0
2"	+16 — 0
3"	+20 —10
4"	+20 —10
5"	+20 —10
6"	+20 —10
10"	+30 —20
12"	+30 —20
15"	+40 —20
Micrometers	+25 —25

•

These End Measuring Rods are made from selected steel and are hardened, seasoned and lapped to the tolerances shown above.

•

Other sets can be had upon application and made to specifications requested.

A complete inspection and reconditioning service is maintained at our plant.

Rods and micrometer heads can be purchased individually or in sets.

Set No. 1 consists of two each 1", 2", 3", 4", 5", 6" and four 12" Measuring Rods with two 4" Micrometer Heads in a wood case. Price **$375.00**

Metric Set 1M consists of two each 25mm, 50mm, 75mm, 100mm, 125mm, 150mm and four 300mm Measuring Rods and two 100m heads in a wood case. Price **$375.00**

Set No. 2 consists of two each 1", 2", 3", 4", 5", 10" and one 15" Measuring Rod with two 4" Micrometer Heads in a wood case. Price **$345.00**

Set No. 3 consists of two each 1", 2", 3", 4", 5", 6" and five 12" Measuring Rods with two 4" Micrometer Heads in a wood case. Price **$415.00**

Set No. 4 consists of two each 1", 2", 3", 4", 5", 6" and eight 12" Measuring Rods with two 4" Micrometer Heads in a wood case. Price **$537.50**

Set No. 5 consists of two each 1", 2", 3", 4", 5", 6" and ten 12" Measuring Rods with two 4" Micrometer Heads in a wood case. Price **$615.00**

Set No. 6 consists of two each 1", 2", 3", 6" and one 12" Measuring Rod with two 4" Micrometer Heads in a wood case. Price **$245.00**

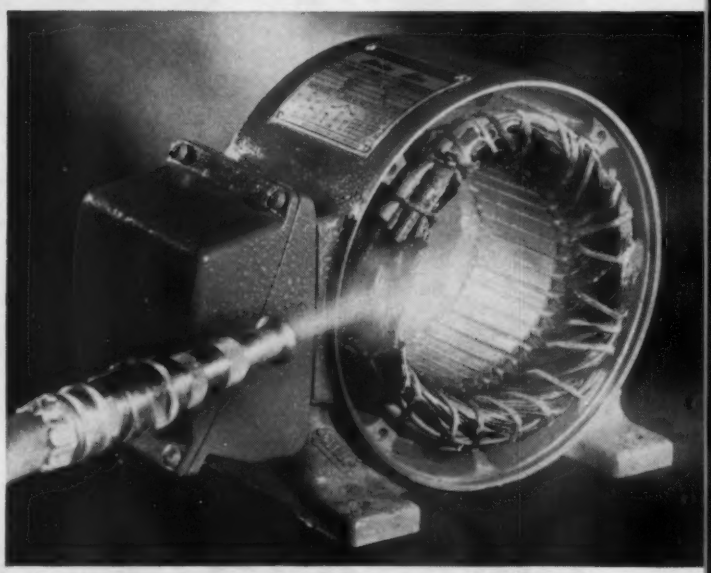
SWEDISH GAGE COMPANY OF AMERICA

10641 HAGGERTY • DEARBORN 1, MICHIGAN

C. E. JOHANSSON GAGE COMPANY, A DIVISION

DISTRIBUTOR OF JOHANSSON GAGE BLOCKS

MOTOR FACTS ON INDUSTRY'S
MOST PREFERRED "POWER PACKAGE."



Electrical System Fact—New exclusive Bondite impregnating varnish, partner to new Bondar and Mylar* insulations, guarantees complete resistance to weather. It doesn't just repel, it resists—all the way through.

*Du Pont Registered Trade-Mark

FACT:

The new Life-Line A is the most weather-resistant motor on the market

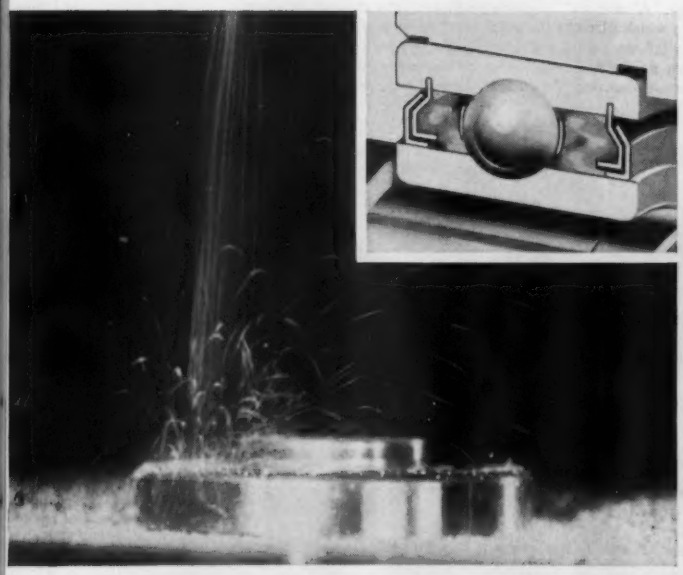
Whether your application is hot—cold—wet or dry, you'll find the new Westinghouse Life-Line® "A" motor will last longer under more extreme weather conditions than any other motor you can buy.

New insulation materials, housing designs, 4-way sealed bearings are tangible evidence of electrical, mechanical and lubrication system improvements that make Life-Line "A" industry's most preferred package of power.

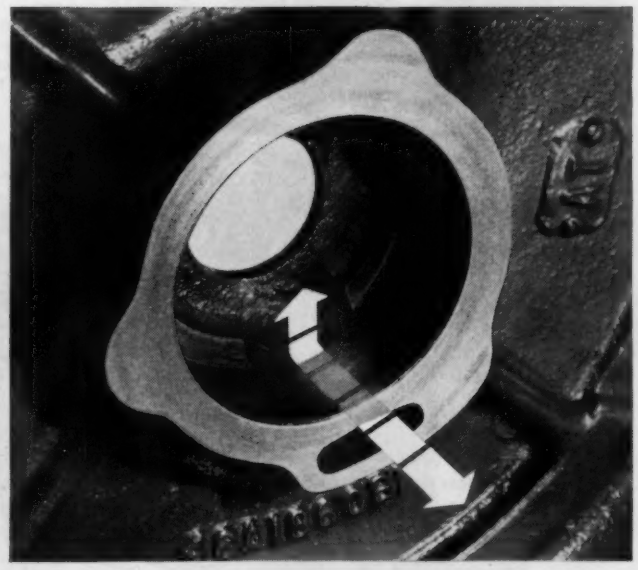
Get all the facts by calling your Westinghouse sales engineer . . .
The Man With The Facts.

J-21882

YOU CAN BE SURE...IF IT'S
Westinghouse



Lubrication System Fact—Two outer seals of new 4-way sealed bearing act as flingers and literally (see photo above) throw off damaging contaminations. Inner seals, attached to outer bearing race, are stationary and form a positive labyrinth with outer seals.

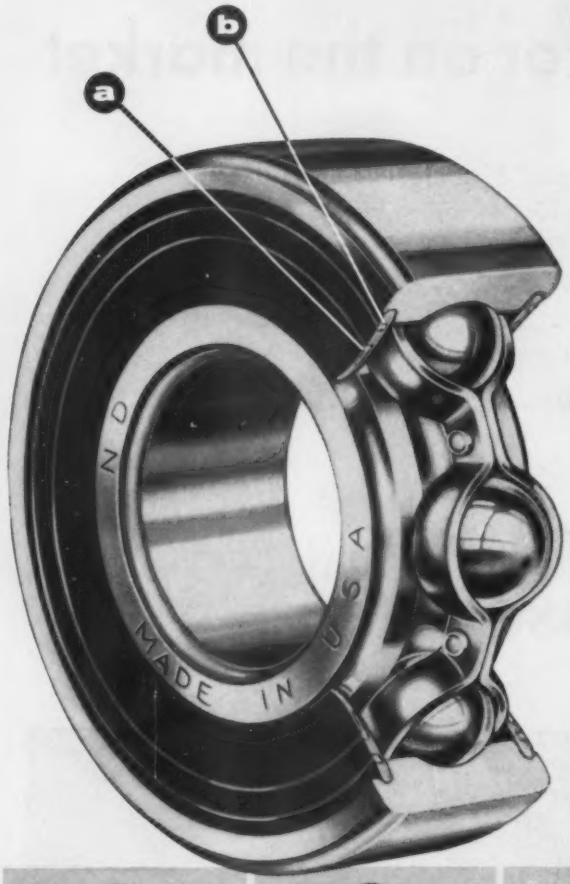


Mechanical System Fact—New exclusive air by-pass on totally-enclosed motor permits the motor to breathe around the bearing—not through it—minimizing atmospheric damage. Finest grained castings used in new cast-iron housings.

FACTS

about

NEW DEPARTURE
BALL BEARINGS



New Sentri-Seal...on guard against dirt and wear!

The unique design of the Sentri-Seal gives optimum protection against dirt, and includes a number of other major advantages.

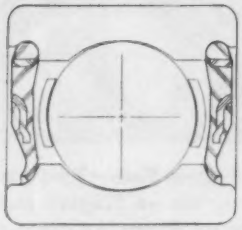
Sentri-Seals are quickly removed, easily replaced. As the seal is of synthetic rubber, in which two metal rings are embedded, a constant-rate spring is created between the rings. Inherent flexibility prevents distortion of the bearing outer ring due to seal insertion, permitting the use of bearings to the higher accuracy specifications. The spring action maintains an efficient sealing contact with the bearing ring to bar dirt and retain lubricant. Sentri-Seals are relatively inert to oils and greases and operate satisfactorily through a temperature range of −40°F to 225°F. Specifications available for still higher temperatures. In applications where relubrication is desired, it is easily accomplished by the injection method.

The New Departure Sentri-Seal basically consists of two separate metal rings, "A" and "B", embedded in synthetic rubber, resulting in a spring which absorbs distortion and deflection. The seal is not drastically influenced by axial displacement due to bearing end-play within prescribed tolerances, and provides efficient sealing at low torque. Bearing shown is equipped with two seals.

ONE SENTRI-SEAL | SEAL AND SHIELD | SEAL AND SNAP RING | TWO SEALS AND SNAP RING | SEAL, SHIELD AND SNAP RING

The diagram shows in section the New Departure Sentri-Seal. Lip contacting surfaces are form-ground simultaneously with the ball race, giving an extremely high degree of concentricity between sealing surfaces and the raceway.

Sentri-Seal is available for a range of sizes in single-row, standard-width bearings and also in two types of New Departure adapter bearings. Sizes, dimensions and capacities are listed in the latest New Departure catalog.



Write for full details on Sentri-Seal

NEW DEPARTURE • DIVISION OF GENERAL MOTORS • BRISTOL, CONN.

ALL NEW

Lodge & Shipley

10" Hi-Turn LATHE

PERFECTED FOR PRODUCTION!

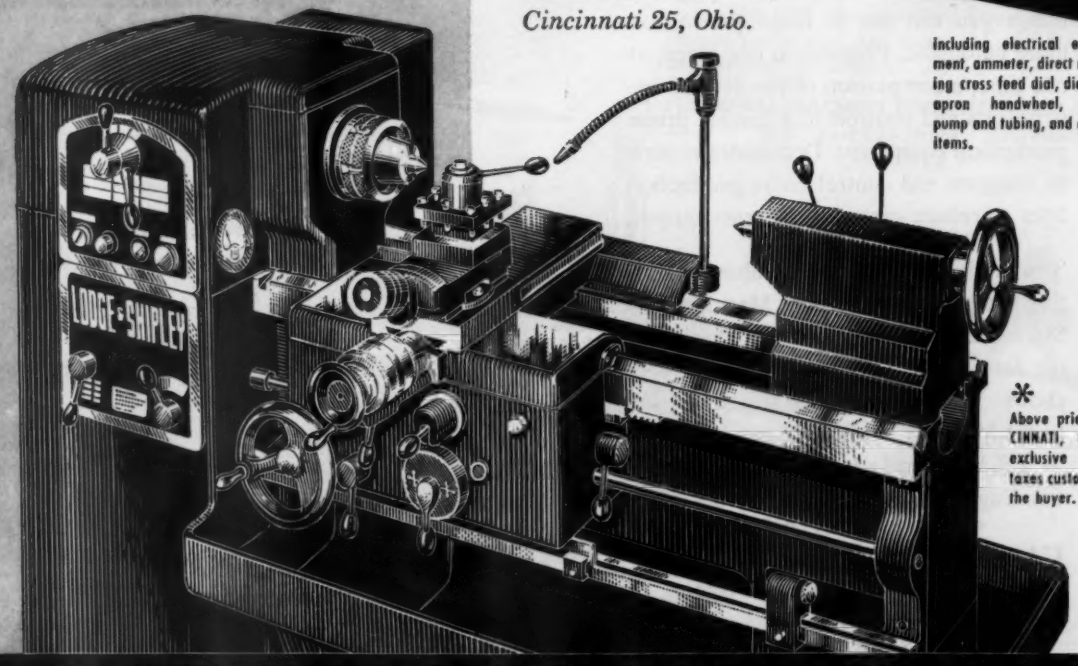
... never before ... so many features ...
so much quality ... at such low cost!

- 9 color-coded speeds up to 3000 RPM and 5 HP
- Totally enclosed quick change gear box
- Dynamically braked motor in leg
- Template-type length stops, magnetic clutch operated
- Flame-hardened replaceable steel bedways
- Hardened and ground cross slide ways
- Direct reading cross feed and top slide dials
- Provision for rear tool block and multiple tools

The Lodge & Shipley 10" HI-TURN Lathe is a completely new concept in lathes. Establishing that lathes for high speed production rarely utilized leadscrews, Lodge & Shipley eliminated the leadscrew and its complicated gearing . . . added other features for high production and accuracy at low cost. The result is a rugged lathe of high efficiency at a price substantially lower than conventional lathes.

Write for detailed Bulletin 300, The Lodge & Shipley Co., 3055 Colerain Avenue, Cincinnati 25, Ohio.

only **$4,985*** including electrical equipment, ammeter, direct reading cross feed dial, dial for apron handwheel, pan, pump and tubing, and other items.



* Above price is FOB CINCINNATI, OHIO and is exclusive of applicable taxes customarily paid by the buyer.

SEE IT NOW! and *SEE IT* AT THE MACHINE TOOL SHOW, SEPTEMBER 6-17

the PRODUCTION ENGINEERING SHOW

SEPTEMBER 6-16, 1955
NAVY PIER, CHICAGO

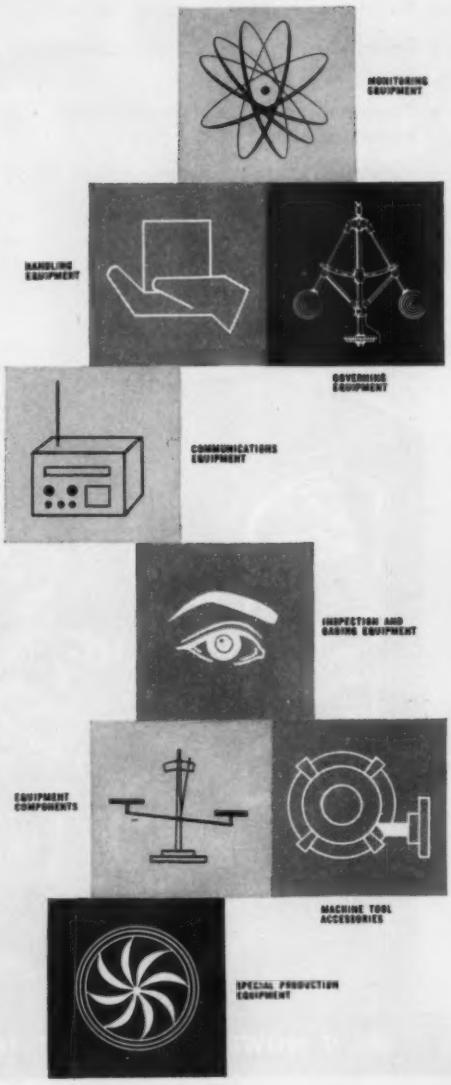
The Automation Exposition

See the devices, instruments, mechanisms and controls of automation you can apply right now!

An exposition that does something about AUTOMATION. Takes it out of the "blue sky" category. Shows you the practical things you can use to make production more automatic. Provides in one place, at one time, a comparison of the devices, instruments and controls to automate prime production equipment. Demonstrates how to integrate and control entire production lines to reduce costs and increase output.

The Production Engineering Show is a fitting companion to the great Machine Tool Show, held simultaneously in Chicago at the International Amphitheatre. See both shows. Your P.E.S. badge will admit you to the Machine Tool Show, too. And your M.T.S. badge will admit you to the Production Engineering Show. Write for tickets to:

Clapp & Poliak, Inc.
Dept. PES-2, 341 Madison Avenue,
New York 17, N. Y.



17,032*

General Managers looking for BETTER METHODS!

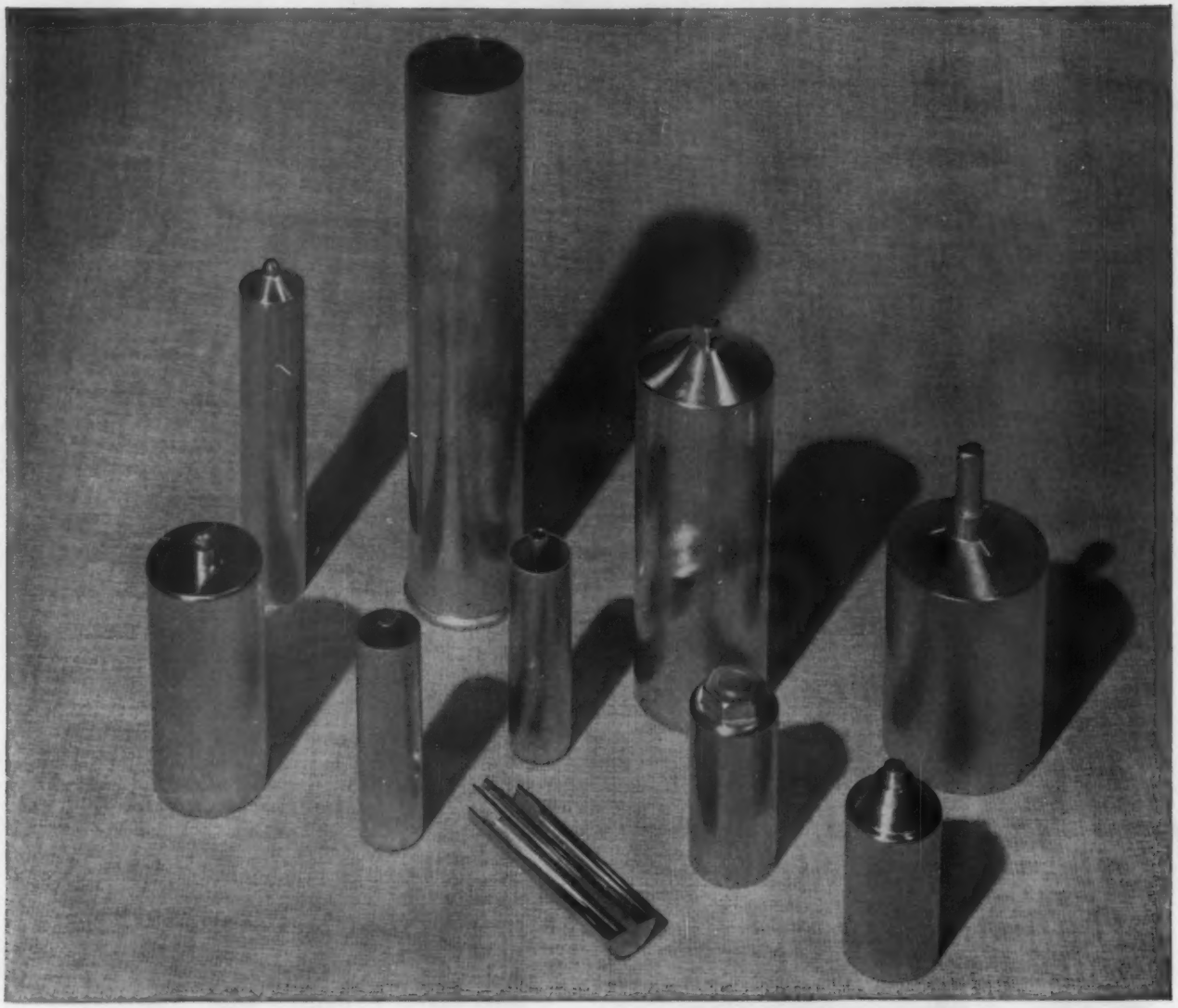
Plan *now* to join them—at the Machine Tool Show. You'll find a wealth of answers to each of your metalworking problems. More than ninety per cent of the country's leading machine tool builders will be on hand, ready to show you their newest models, their fastest, most ingenious, most economical production methods.

It's the largest and most important show of its kind; one you can't afford to miss. The last time it was held, in 1947, all attendance records were broken—and this time even greater crowds are expected. The Production Engineering Show, being held on the Navy Pier, in Chicago, on the same dates, offers a bonus attraction that's hard to beat; a chance to see the latest in machine tool accessories at no additional cost. The same badge will admit you to both shows.

Bring your key production people to Chicago in September; share with them this unequaled opportunity to see the latest developments in machine tools. The 1955 Machine Tool Show is the best chance you've ever had to see **the world's best investment**—***in action!***

NATIONAL MACHINE TOOL BUILDERS' ASSOCIATION
2071 East 102 Street • Cleveland 6, Ohio

* Estimated Attendance, Before Receiving Your Reservation



ALUMINUM CANS—any size...any quantity!

With our extensive impact extruding facilities, Hunter Douglas is able to supply unlimited quantities of non-structural 2S or 3S aluminum cans to your specific design requirements.

We are at present manufacturing cans of this type in round, square, and other shapes for the electronics industry, and for use in many ordnance components. In addition to the cans pictured, part geometry can vary to conform to many unusual and special requirements.

If you use *condenser cans, vacuum tube shields, transformer and relay shields, pyrotechnic cans, containers—or similar products made from* aluminum, ask for our quotation and prompt delivery schedules! Airmailed or telephoned requests will give quick answers to tight production programs.

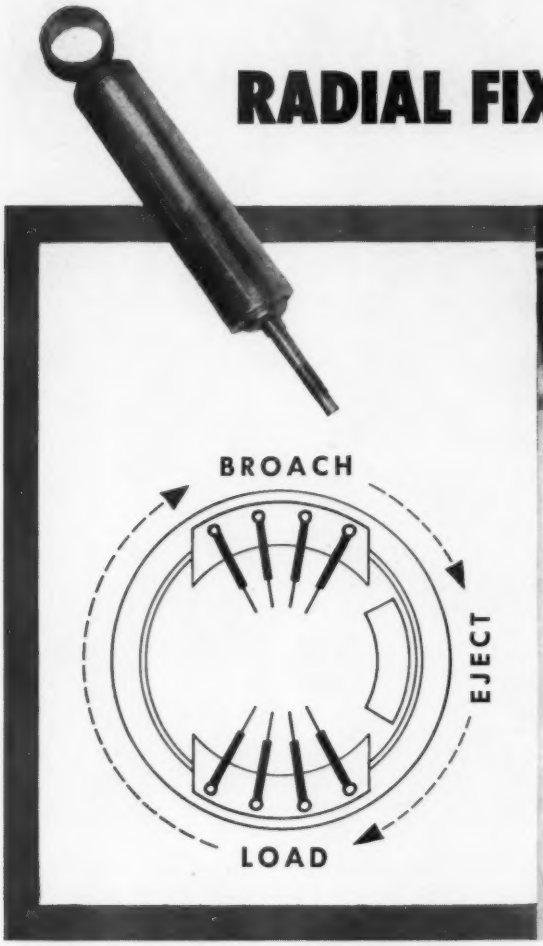
DESIGNERS:
If you want to know more about Hunter Douglas Cold Forgings write on your company letterhead for this free 40 page book, now on the press!

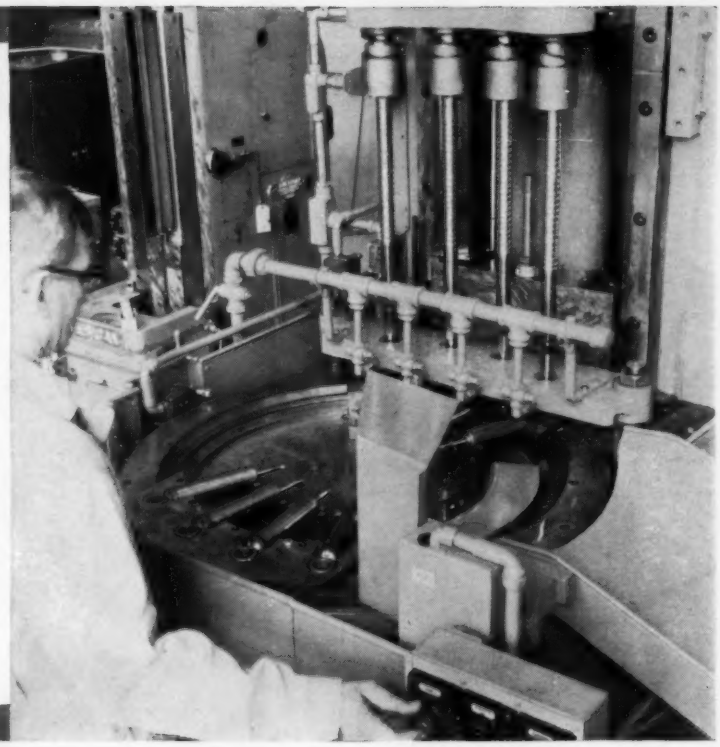
Hunter Douglas Corporation

HUNTER DOUGLAS CORPORATION • DEPT. AM-7 RIVERSIDE, CALIFORNIA TELEPHONE OVerland 3-3030

RADIAL FIXTURE DESIGN

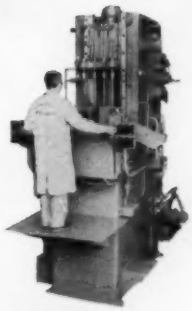
THE MACHINE TOOL SHOW CHICAGO, ILL. SEPT 6-17, 1955 INTERNATIONAL AMPHITHEATRE — BOOTH 1412





contributes to HIGH OUTPUT BROACHING

the *American* way

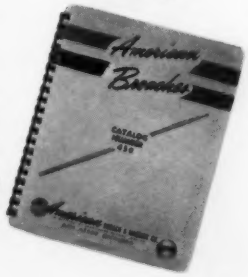


While this American vertical pull-down broaching machine is broaching the inside diameter of four shock absorber yokes, the operator loads the opposite four radial stations of a rotating base fixture. At the end of the broaching stroke, the fixture indexes 90° and automatically ejects the parts down a chute. Fixture then rotates another 90° for loading while the second broaching cycle is begun.

Operation is push-button controlled — output over 1100 pieces per hour.

Unusual tooling to meet specialized production requirements is constantly being developed through creative engineering at American. Whether your broaching problem requires the best in automatic or automated control, or simply an economical adaptation of a standard machine, you will gain by referring your requirements to American. American has been making broaches, fixtures and broaching machines — all three — for over 35 years. To put this experience to work for you, send a blue print or sample part. An American recommendation will be furnished promptly.

Ask for Catalog No. 450



AMERICAN

American BROACH & MACHINE CO.

A DIVISION OF SUNDSTRAND MACHINE TOOL CO.

ANN ARBOR, MICHIGAN

SUNDSTRAND

See *American* First — for the Best in Broaching Tools, Broaching Machines, Special Machinery

For greater production today . .

greater stamina for carbides or HSS tooling

all slides provide support without tool overhang

controlled cycle time keeps production on schedule

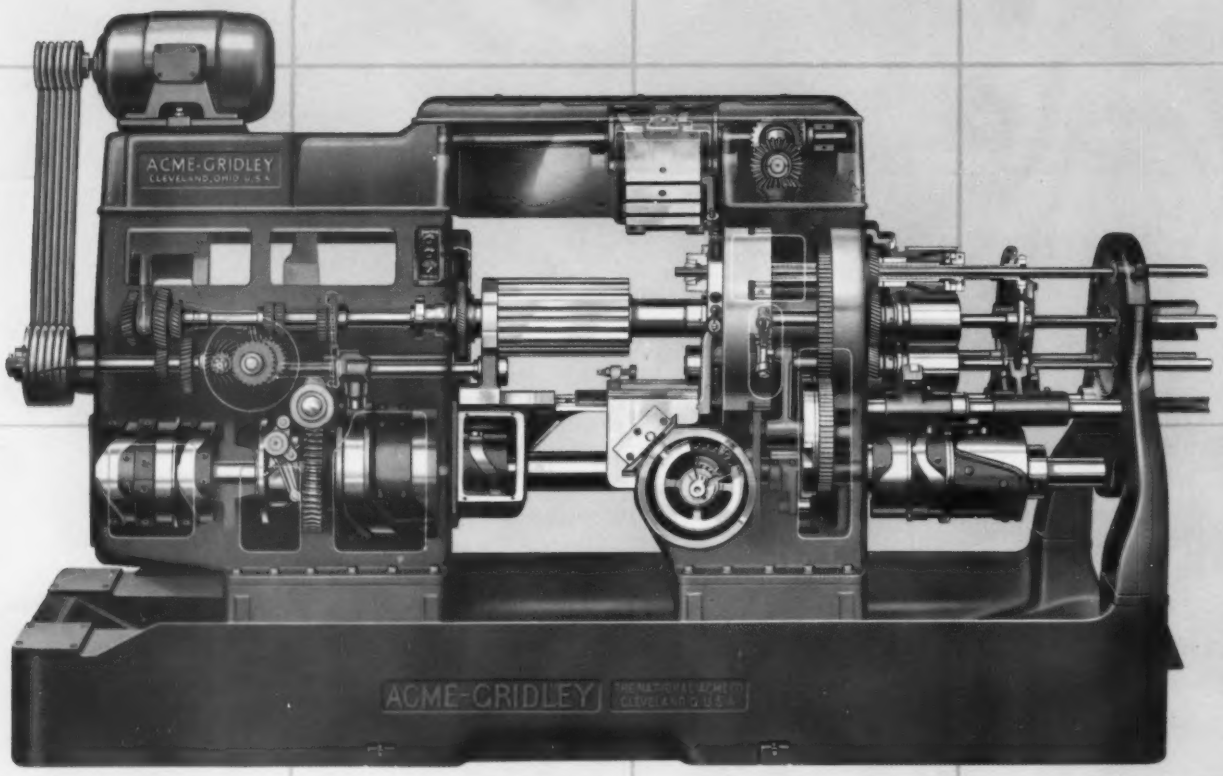
wider, heavier slides for more operations

lubricating and coolant systems completely separated

hardened steel cams for all slide movements

toolholder designs simplify set-up and change-over

independent direct camming for all slides



spindle carrier design insures permanent alignment

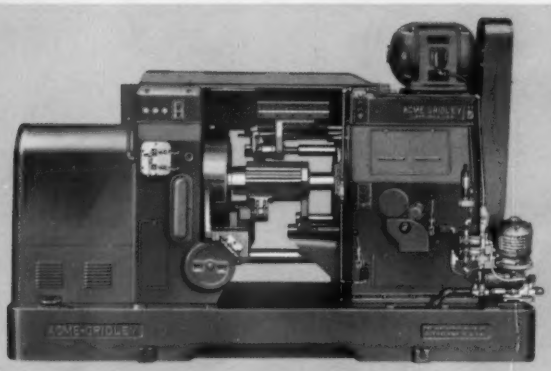
positive camming for thread cutting and thread rolling

precision cut cams for accurately balanced feeds

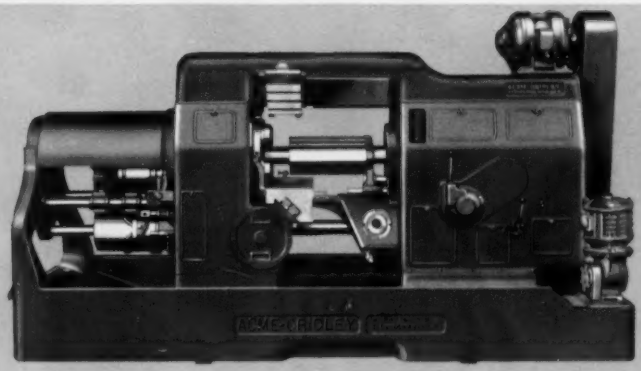
power reverse on larger machine sizes

....and for the long pull...

you'll get **MORE** out of Acme-Gridleys today and for years to come, because National Acme builds **MORE** into Acme-Gridleys



CHUCKING AUTOMATICS — 4-Spindle: 2 sizes, 10 and 12". 6-Spindle: 4 sizes, 5¼ to 12". 8-Spindle: 2 sizes, 6 and 8".



BAR AUTOMATICS — 4-Spindle: 7 sizes, 1 to 7¾". 6-Spindle: 9 sizes, 9/16 to 6". 8-Spindle: 6 sizes, 5/8 to 4".

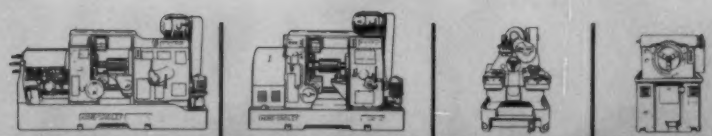
Acme-Gridley design features, responsible for outstanding production gains in shop after shop, are not always apparent from the outside of the machine. You have to look at the "works" of an Acme-Gridley to see why so many of them are in use.

Here, you will find plenty of evidence that National Acme builds more stamina and ruggedness, and greater potential for accuracy — than normally will ever be needed. Here you will also see why Acme-Gridleys top anything in their field today — and will continue to deliver "new-machine-productivity" longer.

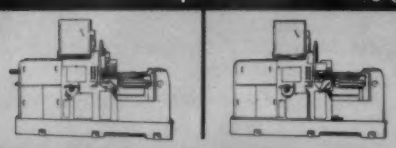
Typical of this continuing design improvement are the features listed on these pages. Check them at the Machine Tool Show. Whether you attend the show or not, ask us to demonstrate them to you at your convenience.

THE MACHINE TOOL SHOW CHICAGO, ILL.

BOOTHS 705 AND 324



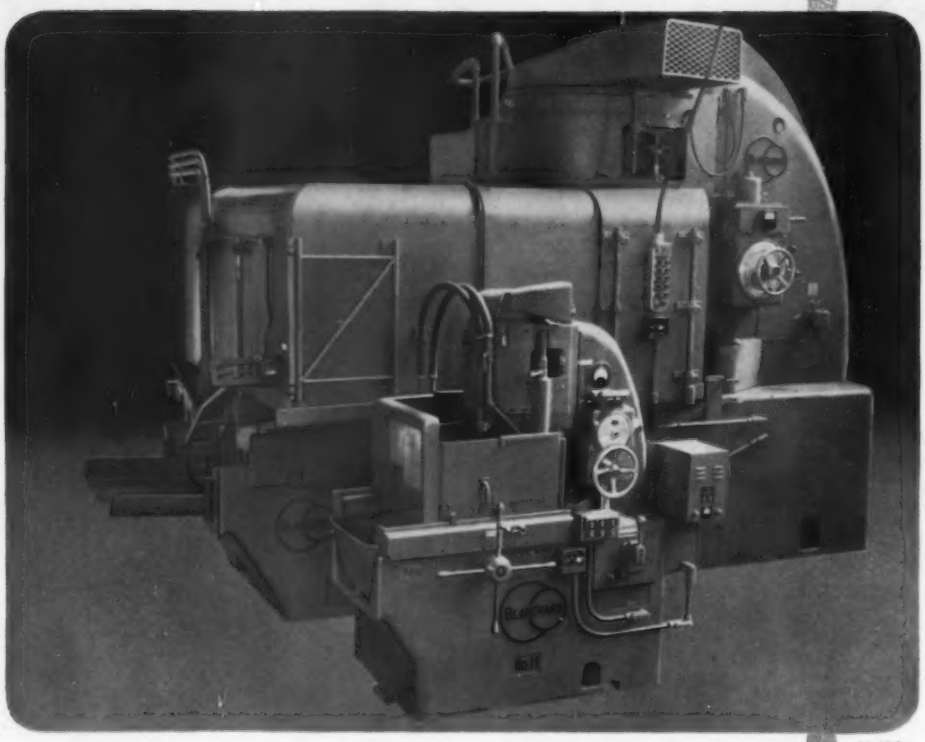
OUR JOB: to provide the *Right Machine* for **YOUR JOB**



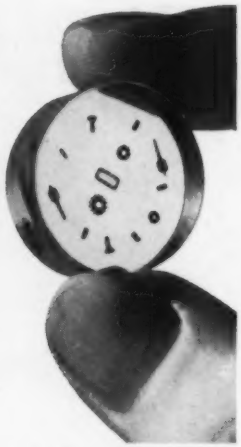
Acme-Gridley 4, 6 and 8 Spindle Automatic Bar and Chucking Machines • Fully Automatic Turret Lathes (Bar and Chuck Type) • Hydraulic Thread Rolling Machines • Automatic Threading Tools • Switches • Solenoids • Contract Manufacturing.

THE NATIONAL ACME COMPANY

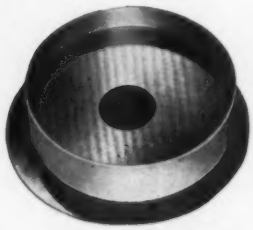
170 EAST 131st STREET • CLEVELAND 8, OHIO



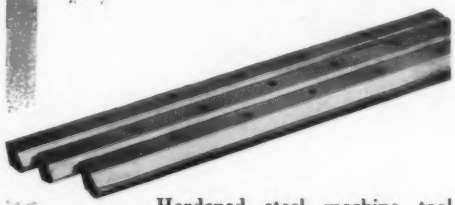
V-488



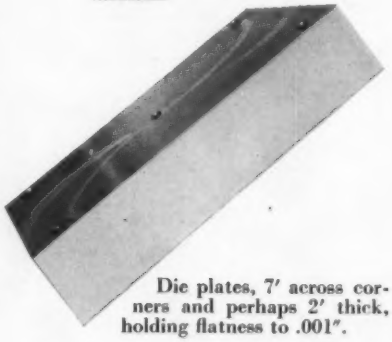
Tiny watch gears, pinions and ruby bearings — flat and parallel — to a dimension tolerance of .0002".



To 3 micro-inches and flat within *one* light band.



Hardened steel machine tool ways, 2½" x 3½" x 50", ground on 6 sides, flat within .001" with surface finish of 5 micro-inches — *5 times faster than other methods!*



Die plates, 7' across corners and perhaps 2' thick, holding flatness to .001".

Please give us a chance!

We *know* we can do *your* flat surface jobs. We've done them all — tiny watch parts . . . steel plates 7 feet across corners . . . copper and ceramics . . . *perfectly*. Just give us the correct wheel . . . (Blanchard wheels are preferable).

Blanchards regularly grind surfaces flat to within 2 to 4 light bands, parallel to less than .0001", with dimension tolerance of .0002" and surface finish to better than 3 micro-inches.

Honest, we Blanchards (15 models) work fast and inexpensively — whether the job requires precision grinding or rapid removal of stock. Give us a chance to prove we're the best investment you ever made.

VISIT BLANCHARD BOOTH NO. 406
AT THE MACHINE TOOL SHOW

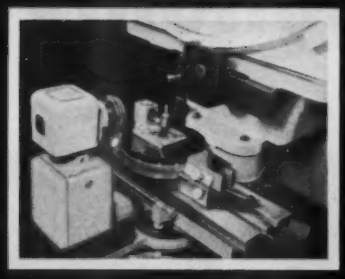
Send for free copies of "Work Done on the Blanchard" (fourth edition), and "The Art of Blanchard Surface Grinding".

PUT IT ON THE BLANCHARD

THE BLANCHARD MACHINE COMPANY 64 STATE ST., CAMBRIDGE 39, MASS., U. S. A.

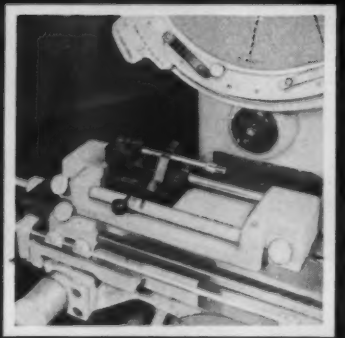
JONES & LAMSON OPTICAL COMPARATORS

Precise . . . Rapid . . . Flexible . . . Easy-to-operate



A J & L Comparator, with special fixture and chart, easily and perfectly measures a 3-dimensional cam. This is traditionally one of the most difficult of all inspection jobs.

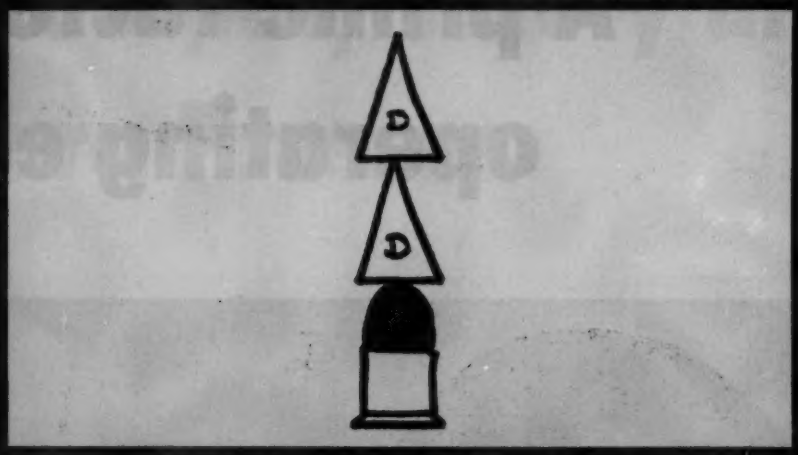
This inexpensive J & L Comparator is precisely measuring four small parts, of different sizes, with the same setup.



Shoulder lengths can be measured to closest tolerance swiftly and accurately with a J & L Comparator. The fixture shown here accommodates a wide variety of parts.

DROODLES

by ROGER PRICE



"DUMB-DUMB BULLET"

Interesting object, the dum-dum bullet. Invented by Sir Basil Fleemster, the famous explorer and hunter. A kind-hearted man, Sir Basil figured that bullets made of extra-soft lead would prove less distasteful, so to speak, to his prey.

He tested his theory on a hunting trip along the lower Zambesi. After Sir Basil had fired on a herd of antelope, his Number One bearer came running up, crying "Bad gnus, sahib — bullet holes big like soup plates!" Fleemster was so devastated by this pathetic turn of events, and the even more pathetic pun, that he hightailed it forthwith to his farm in Sussex, where he now raises peonies. Ah, well — not the first man to be led astray by softheadedness!

Don't *you* be led astray! Be sure to get all the facts on Jones & Lamson Comparators. These precision-built optical instruments measure and inspect all sorts of objects and parts, ranging in size from the tiniest screw to large turbine blades. J & L Comparators make inspection swift and sure, with accuracy to .0001". Whatever the product or component that you make, if inspection, measurement and quality control are important in your production, it will pay you to investigate J & L Comparators. Send this coupon *today!*

Bench Model BC-14D

Pedestal Model FC-30

Pedestal Model PC-14

JONES & LAMSON

JONES & LAMSON MACHINE COMPANY, Dept. 710, 502 Clinton Street, Springfield, Vermont, U.S.A.

- ☐ Please send me Comparator Catalog 402-C (describes complete line). I'd like to see a showing of the movie(s)
- ☐ "What's the Difference" (describes Comparator construction and principles of operation)
- ☐ "Beyond the Shadow of a Doubt" (describes interesting Comparator applications)

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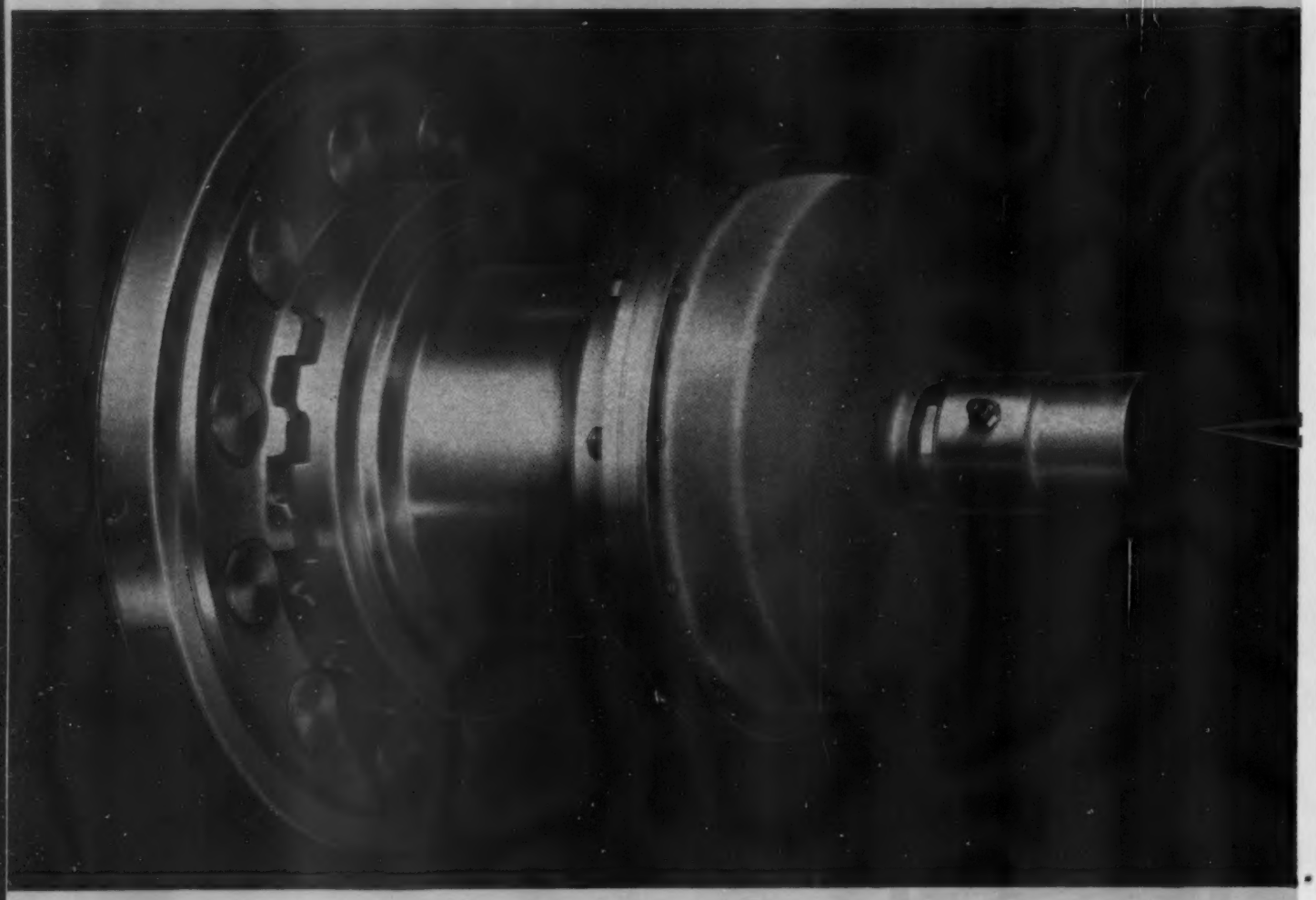
Exclusive NIAGARA Electro-

A prime factor in the operating economy



●Examine it. See it operate. Try it yourself. Compare it point for point. The Niagara Electro-Pneumatic Clutch is distinctly superior in every respect: hourly output ... ruggedness ... simplicity ... safety ... savings in operation and maintenance. *It's functionally different in every major detail!*

There, in a nutshell, you have one of the principal reasons why Niagara presses continually out-perform all others. For fact-loaded details, as applied to single or double crank inclinable, gap frame, horn and deep throat presses, request specific literature and consult with a Niagara representative.

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Pneumatic Clutch

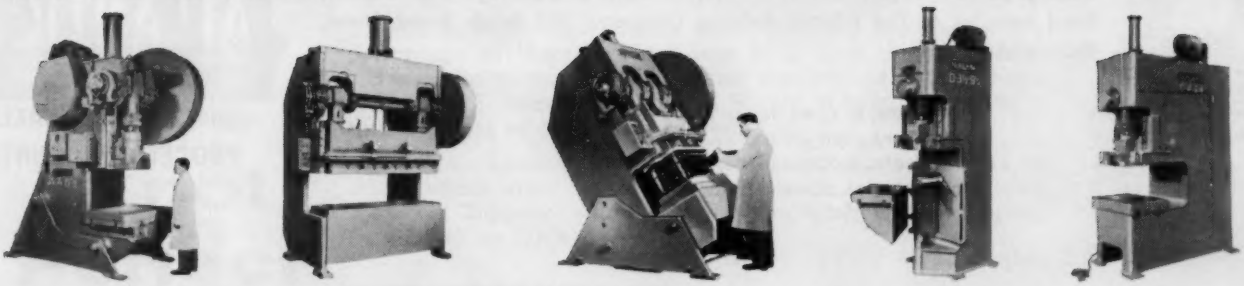
greater output, safety and of Niagara Presses

For Better Performance and Safety

- ENGAGES AND DISENGAGES INSTANTLY at any point in the stroke.
- CAN BE SINGLE-STROKED, JOGGED (forward and in reverse) or operated continuously.
- STOPS INSTANTLY by push button, electric eye, limit switch or similar devices — regardless of crank position.
- PROVIDES EFFORTLESS PRESS OPERATION by palm buttons or foot switch.
- FAILS SAFE. Press stops automatically if electric current or air pressure fails.

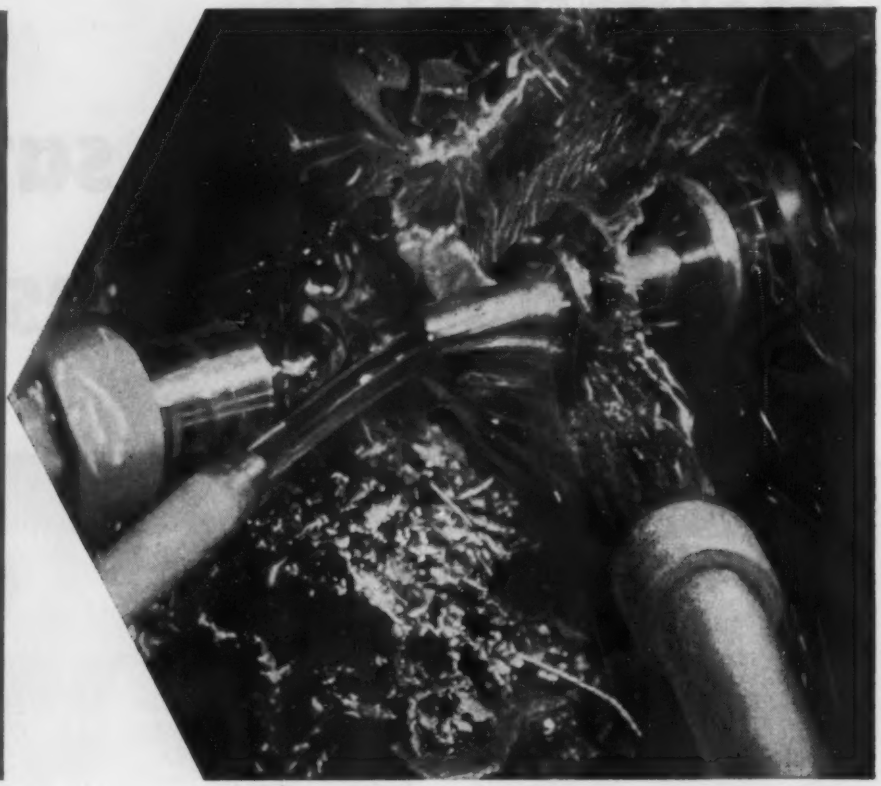
For Less Maintenance

- NO FRICTION SURFACES to slip, heat up and wear.
- SIMPLE, COMPACT DESIGN. Nothing to adjust.
- LOW INERTIA. Small in diameter. Operates directly on crankshaft, *the slowest rotating shaft*. No gears nor high speed shafts, etc. to start and stop
- LENGTHENS GEAR LIFE. Wear is distributed uniformly, because engagement load is not always applied to same teeth.
- RUNS IN SEALED BATH OF OIL to minimize wear.
- EASILY ACCESSIBLE. Mounted at end of shaft, external to flywheel.
- NO BUCKING of clutch vs. brake.



America's Most Complete Line of Presses, Shears, Machines and Tools for Plate and Sheet Metal Work

NEW
ATLANTIC
Cutting
Oils



Cut the Tough Jobs Down to Size

No need to pamper these Atlantic Cutting Oils. Put them to work on the toughest cutting job in the shop. Then see the difference they can make . . . in long tool life, top production, even in shop morale.

Notice how Atlantic non-soluble cutting oils give you high production on hot, tough jobs — and without foul odors. Note, too, that the work is visible right through the oil. All these oils are compatible when blended.

Operators like Atlantic Cutting Oils because they do not indelibly stain hands and clothing . . . they make a cleaner shop possible.

You can get full information on these oils and a copy of the valuable new Cutting Oil Selector Chart, which shows how to select the right Atlantic Cutting Oil for the job. Just write for your copy to a nearby Atlantic office, listed here, or to The Atlantic Refining Company, 260 South Broad Street, Philadelphia 1, Pa.

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ATLANTIC

LUBRICANTS · WAXES
PROCESS PRODUCTS

Where 100% is not Perfect

Thread strength tests clearly show that any increase in the percentage of thread height over 60% does not materially increase the strength. For the vast majority of tapped holes 55% to 75% thread is adequate. Rarely, if ever, will a 100% thread height be economical or desirable.

For a complete discussion of this point, and dozens of others which affect threading results, write for "Facts About Taps and Tapping" — the new and completely revised tapping *handbook* by GREENFIELD.

GREENFIELD TAP and DIE CORPORATION

Greenfield, Massachusetts

CASE HISTORY NO. 1—HIGH-SPEED STEEL KNIVES

MATTISON HIGH-POWER

GRINDING METHODS

66 knives are loaded on the 168" chuck . . . ground on both sides in 2¾ hours. Stock removal is .024".

Courtesy—Lancaster Machine Knife Works, Inc.

Production doubled . . . setup time cut 25% . . . parallelism held within .0005"

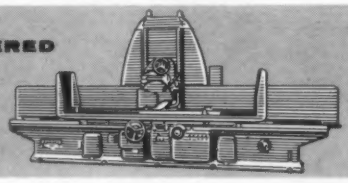
Two sides of steel knives (Rockwell 64-65C) are ground parallel within .0005" . . . finish is 12 micro inches, RMS.

Here's how the Mattison High-Powered Precision Surface Grinder can boost profit-power in almost any shop that works metal!

Production of high-speed steel wood planing knives, for example, is 100% faster than the former method . . . work is 25% more accurate . . . and setup time has been cut 25%.

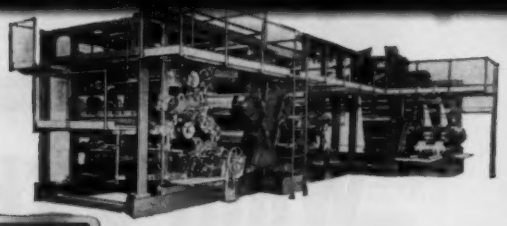
Though the results are typical, this job represents only a small part of the machine's virtually unlimited work range. For, almost every new user reports more and more jobs are being switched to the "Mattison"—jobs which include grinding flat and contour surfaces to toolroom tolerances . . . machining multiple, small parts and large, heavy castings . . . fine finishing and fast, heavy stock removal . . . shoulder and edge work . . . interrupted surfaces . . . jobs you may now be milling, broaching, or hand scraping. It's a versatile method having numerous applications in every metal working plant! Send your pieceparts to the Mattison Methods Laboratory for a sample grind and production estimate.

HIGH-POWERED SURFACE GRINDERS



MATTISON MACHINE WORKS ROCKFORD ILL. U.S.A.

Greenfield, Massachusetts



a long reach...

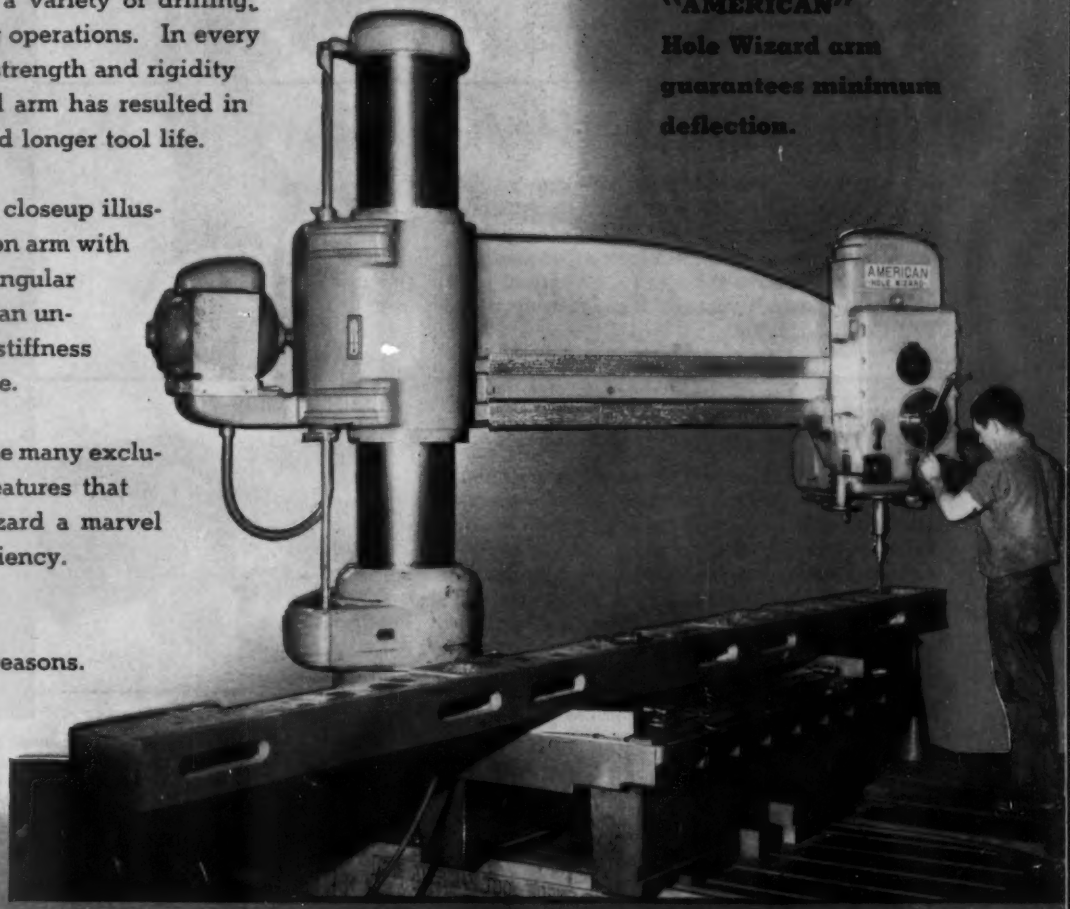
The Cottrell Company, world famed for multi-color printing press manufacture, relies on a 7′ arm, 17″ column "AMERICAN" Hole Wizard Radial for a variety of drilling, tapping and boring operations. In every instance the extra strength and rigidity of the Hole Wizard arm has resulted in greater accuracy and longer tool life.

The accompanying closeup illustrates the box section arm with its full length triangular ribbing, providing an unmatched degree of stiffness and stress resistance.

This is but one of the many exclusive "American" features that make the Hole Wizard a marvel of productive efficiency.

Bulletin No. 327
tells you all the reasons.

It's a long reach but the super-stiffness of the "AMERICAN" Hole Wizard arm guarantees minimum deflection.



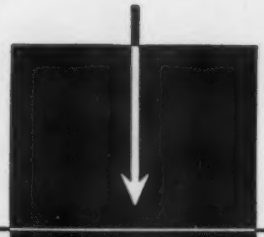
THE AMERICAN TOOL WORKS CO. Cincinnati 2, Ohio, U. S. A.

LATHES AND RADIAL DRILLS

NUMBER ONE IN A SERIES

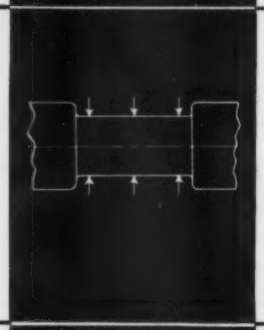
What's The Best Way To Gage These Parts ?

Tips from Taft-Peirce on when and where to use a T-P CompAIRator Air Gage



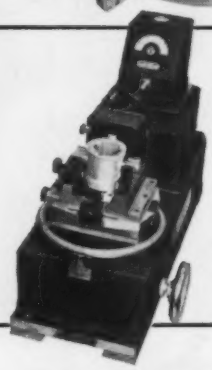
Three OD's
Tolerance: .0009″

One three dial T-P CompAIRator and Air Snap Gage checks three points simultaneously on the journals of an automotive crankshaft. Functions of the diameter (taper, barrel shape, etc.) may be seen at a glance. Simple, accurate, fast — savings in inspection time alone paid for this unit in short order.



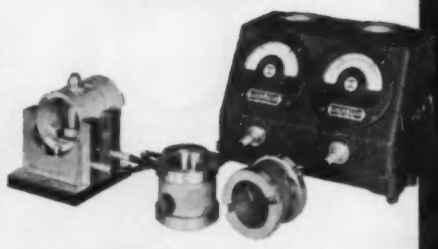
Ovality
Tolerance: .007″ on radius

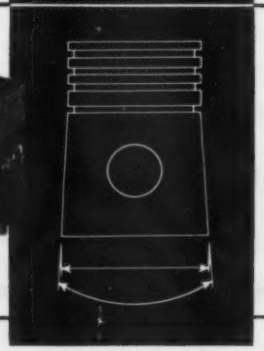
One single dial CompAIRator Air Gage checks the contour of the skirt section on this piston. Indexing table is graduated in 5° increments, permits checking entire contour at one setup. Extremely sensitive yet sturdy, vibration, jarring, tilting won't disturb the accuracy of a T-P CompAIRator.



Taper and Diameter
Tolerance: .002″

A two dial T-P CompAIRator slashes former inspection costs. One indicator checks diameter. The other, a new T-P Computing CompAIRator, measures and *figures* the taper. Indicates it directly on the dial face. Eliminates usual 2 measurements and a computation. Computing CompAIRators may also be used to check center distance, concentricity of diameters, and squareness of bore to face.





For more examples and the complete story on Taft-Peirce CompAIRator Air Gages send for Bulletin.

T-P means Top Precision

WHAT IS A COMPAIRATOR AIR GAGE?

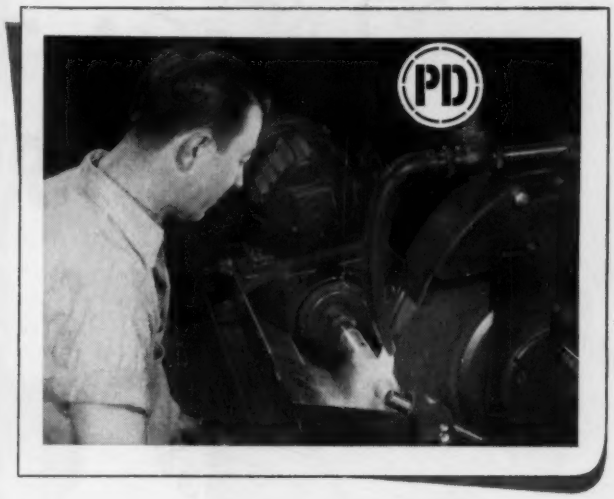
A CompAIRator is a sensitive gaging instrument that measures variations in the velocity of tiny jets of air. When work is placed over these jets, air flow is restricted and its velocity reduced. Any change in air velocity reflects a change in part size, which is immediately shown on a calibrated indicator. Since only air contacts the part in most cases, there is minimum wear on gaging members. Fast, accurate, dependable, a T-P CompAIRator is simple to operate, requires little or no maintenance.

STANDARD AND SPECIAL COMPAIRATORS | COMPUTING COMPAIRATORS | AUTOMATIC SORTING MACHINE | AIR ELECTRIC COMPAIRATORS

THE TAFT-PEIRCE MANUFACTURING COMPANY, WOONSOCKET, RHODE ISLAND

The most important grinding wheel development in years...

JUST AS A NEGATIVE guarantees you an exact duplication of a photograph each and every time, you are always assured a



POSITIVE DUPLICATION of an original grinding wheel each and every time through the CINCINNATI (PD) Manufacturing Process.

NOW!

Cincinnati Grinding Wheels offer

PD

Positive Duplication

When you see what Positive Duplication can do for your plant, you'll agree that here is a truly remarkable development.

Positive Duplication is an achievement in precision manufacturing and quality control that absolutely can save you money . . . and increase your production.

Through the CINCINNATI (PD) Manufacturing Process you are assured a Positive Duplication of the original wheel *every* time you reorder. "On grade" with a CINCINNATI (PD) WHEEL means all future (PD) WHEELS will act and grind exactly alike.

Yet CINCINNATI (PD) WHEELS *are priced no higher than ordinary wheels.*

We'll be glad to prove to you how CINCINNATI (PD) WHEELS can save you money and increase your production. Just contact us and we'll send one of our representatives—men who know grinding and grinding machines as well as grinding wheels. Write, wire or telephone Sales Manager, Cincinnati Milling Products Division. The Cincinnati Milling Machine Co., Cincinnati 9, Ohio,

CINCINNATI
Grinding Wheels

A PRODUCTION-PROVED PRODUCT OF THE CINCINNATI MILLING MACHINE CO.

The slowness of shipping had Brown in a knot.
To set himself free he'd have given a lot...

Then he straightened things out this fast, easy way,
Now **RAILWAY EXPRESS** speeds his shipments today!

The big difference is

Whether you're sending or receiving, whether your shipment is big or small, and whether it's moving by rail or air—you'll find it pays to specify Railway Express. It makes the big difference in speed, economy, and safe, sure delivery.

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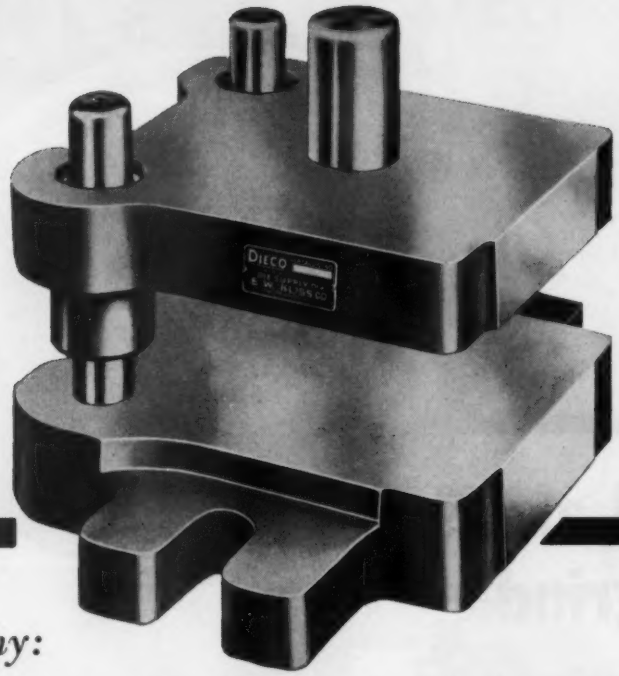
REMINDER:

Be sure you take advantage of the new low Railway Express rates that now apply on a wide variety of clothing shipments. Reductions run as high as 25%. No size or weight limitations. Ask your local Railway Express agent for information on these new rate reductions.

RAILWAY EXPRESS AGENCY

...safe, swift, sure

DIECO, *the midwest's favorite die set, is—*
RAPIDLY BECOMING A NATIONWIDE FAVORITE!



here's why:

- Hardened steel pins are rough and finish ground, then *super-finished.* Closer tolerances give more accurate guiding.
- High-tensile steel plates are first *stress-relieved,* then precision machined—perfectly parallel, they stay parallel under load.
- All parts electronically gaged for perfect fit.
- Choice of bronze-lined on hardened steel backing or hardened steel bushings—all with grease fittings. Precision ground and micro-honed to less than a "tenth" tolerance; can be arranged for pressure lubrication.
- Welded or screw shanks; any length guide pin.
- 1728 combinations in steel or semi-steel—interchangeable parts speed delivery.

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E. W. BLISS COMPANY
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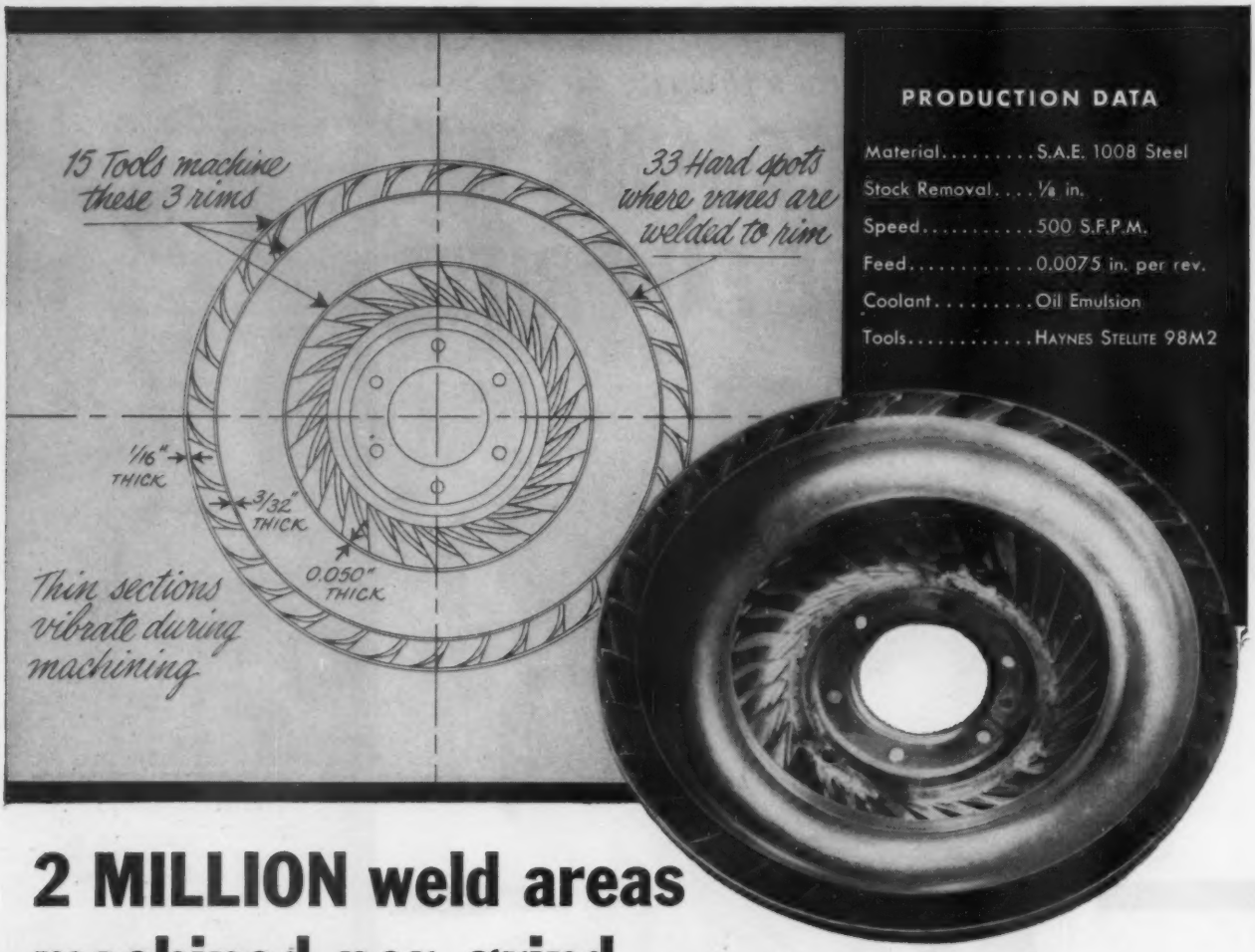

2 MILLION weld areas machined per grind

HAYNES STELLITE 98M2 tools machine 1,000 of these torque converter turbine wheels between grinds. Fifteen tools are used to machine the three rims. There are 33 weld areas on one of the rims where the vanes are joined to it. On every revolution a HAYNES STELLITE tool cuts through these hard spots. It makes 2,100 interrupted cuts per wheel . . . over two million per grind. In addition, all 15 tools must withstand the shock set up by vibrations of the thin sections.

The parts are double indexed on an automatic lathe at six stations. Spindle speed is about 160 revolutions per minute. Feed rate is 0.0075 in. per revolution. Machining speed is 500 surface feet per minute. Total machining time per turbine is 28 seconds, and approximately 125 wheels are finished in an hour. The HAYNES STELLITE tools operate for a full eight-hour shift without chipping or spalling.

HAYNES STELLITE tools have an unusual combination of red hardness and toughness. They remove metal fast because they can take deep cuts at heavy feeds. For full details write for the booklet, "HAYNES STELLITE Metal-Cutting Tools."

HAYNES TRADE-MARK ALLOYS

HAYNES STELLITE COMPANY

A Division of Union Carbide and Carbon Corporation

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CHICAGO, ILL.
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POTTER & JOHNSTON

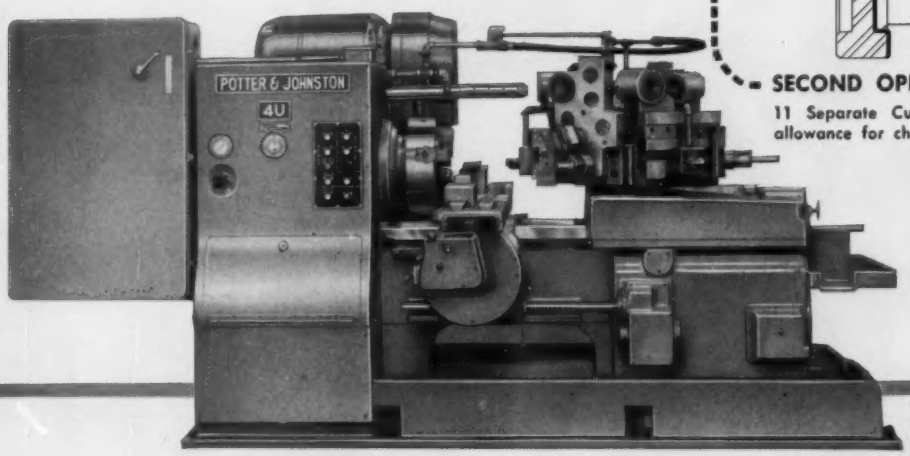
4-U AUTOMATIC TURRET LATHE

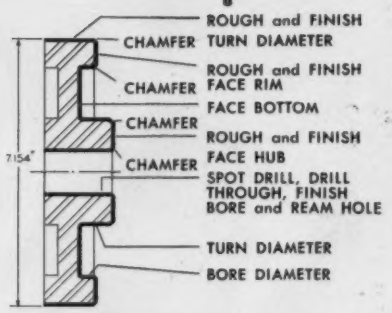
Handles TOUGH STEEL FORGINGS

Quickly . . . Economically

Jobs like machining this change gear blank, forged from 6150 steel, including boring the 1⅛" hole ***from the solid***, are easy, fast, profitable. That's because the P&J 4-U is a ***modern*** machine with the advanced design, added rigidity, and extra speed and power to take today's tough steels in stride.

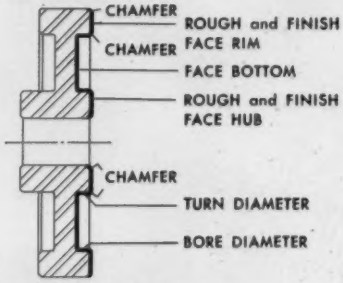
WITH TOOLING ENGINEERED BY P & J EXPERTS





FIRST OPERATION

17 Separate Cuts, 3.41 minutes including allowance for chucking



SECOND OPERATION

11 Separate Cuts, 2.56 minutes including allowance for chucking

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TAKE ADVANTAGE OF DIRECT-FACTORY SERVICE

To serve you best, all P&J Automatics are made available to you through Potter & Johnston and Pratt & Whitney direct-factory Representatives. For full information on the 4-U and other P&J Automatics . . . plus expert application engineering . . . phone or write the P&W Branch Office conveniently near you.

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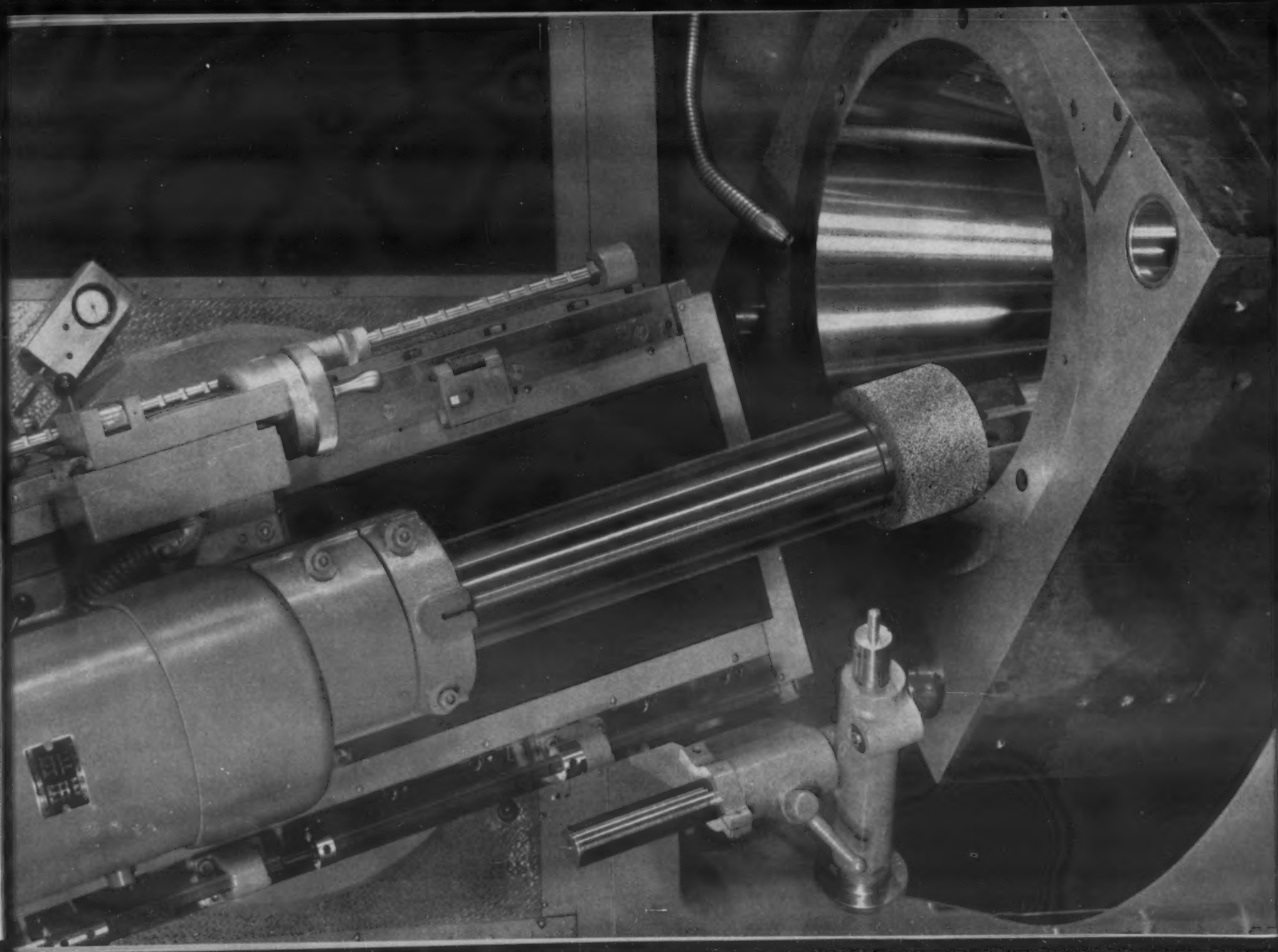
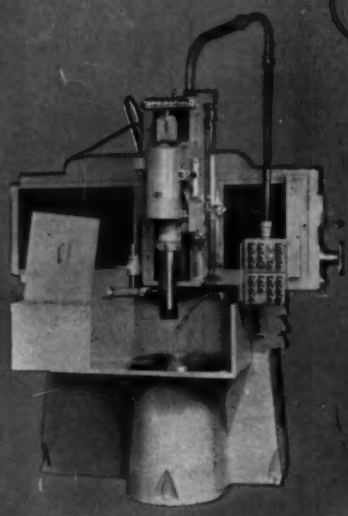
PRECISION PRODUCTION TOOLING P&J FOR MORE THAN FIFTY YEARS



See Springfield at Booth 612, Machine Tool Show, Chicago, September 6-17.



one setup: nine jobs

As flexible, as responsive as a dentist's drill, a Springfield Vertical Universal Grinder can reach around and into a workpiece to do nine different jobs on one chucking.

If you make a pipeline valve, a mold, a bearing race—requiring micro-inch finish on any or all the faces shown in the diagram—at whatever angle—look into Springfield. These grinders cut down the number of set-ups, frequently eliminate hand-lapping, operate with fewer work-holding devices. And, as a bonus, on jobs calling for extreme concentricity, one angle setting of the Springfield head grinds both faces of mating parts.

All three models readily adaptable to special problems.

Vertical Universal Grinders: swings 18″, 24″ and 42″.

Lathes: Engine and tool room, contouring and reproducing—swings 14″ to 32″.

The Springfield Machine Tool Company
Springfield, Ohio
68TH YEAR OF BUILDING IDEAS INTO MACHINE TOOLS

If it's really "just as good..." it's got to be Gargoyle D.T.E.

When you're offered substitutes for Gargoyle D.T.E. oils, remember these facts...

We're always pleased to hear someone say *his* oil is "just as good as Gargoyle D.T.E." It's an admission of an industry-accepted fact... Gargoyle D.T.E. hydraulic oils are the *standard of performance* in this field!

The quality of Gargoyle D.T.E. hydraulic oils is so uniformly high—their performance so dependable—that in hundreds of machines they have given thousands of hours of trouble-free service! This is why they also improve machine production—help reduce manufacturing costs.

Yet, with all these benefits, Gargoyle D.T.E. hydraulic oils cost less than *one-half cent* per machine per hour in hundreds of systems. And when you include the lubrication engineering service that goes with them—the world's greatest—you can see why these famous oils actually save you money in the long run.

So don't accept anything less than Gargoyle D.T.E. oil. It's the *only* oil that's *really* "just as good" as they say!

Socony Mobil

Correct Lubrication

FIRST STEP IN CUTTING COSTS

SOCONY MOBIL OIL COMPANY, INC., and Affiliates: MAGNOLIA PETROLEUM COMPANY, GENERAL PETROLEUM CORPORATION

ACCO products

The WRIGHT Hoist for the Job... Helps Build Production Profits

PURCHASE of WRIGHT Speedway Hoists means more than the cost **PRICE**. It means that you have the very best in plant lift equipment **PLUS** the longest-lived, hardest working hoists with a minimum of **MAINTENANCE** requirements. Production men find them more than the **EQUALS** of any hoists with their easy, smooth-running performance. Their **TOTAL** maintenance is so small and service so easy that "down time" **COST** is hardly considered in plants equipped with WRIGHT Speedway Hoists.

Write our York, Pa. office for any or all of these fully informative bulletins—
Bulletin DH-133B on Frame 1 and 1½ WRIGHT Speedways
Catalog E-54A on Frame 2 and 3 WRIGHT Speedways
Bulletin DH-504 on WRIGHT Electric Roller Chain Hoist

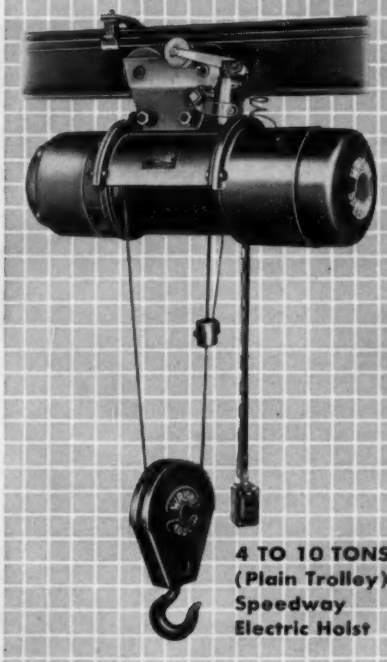
ACCO TRADE MARK

Wright Hoist Division
AMERICAN CHAIN & CABLE

York, Pa., Atlanta, Chicago, Denver, Detroit, Los Angeles, New York, Philadelphia, Pittsburgh, San Francisco, Bridgeport, Conn.

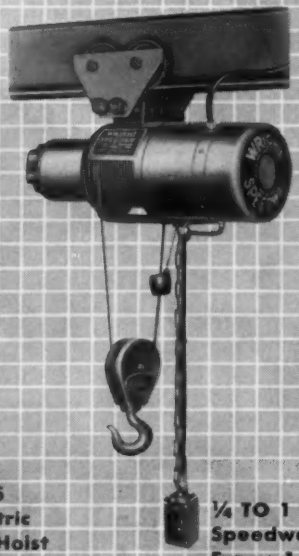
Hoists Trolleys Cranes

THE HOIST FOR THE JOB
(Frame 2 and 3)

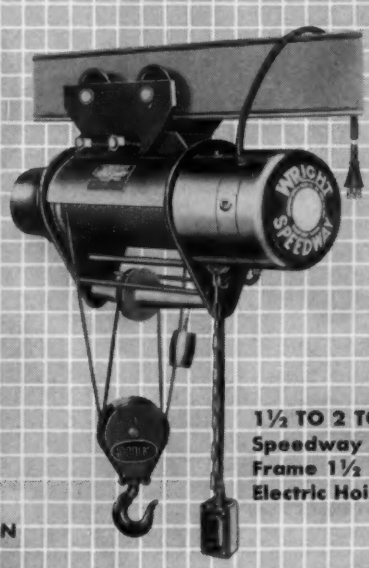


4 TO 10 TONS—
(Plain Trolley)
Speedway
Electric Hoist

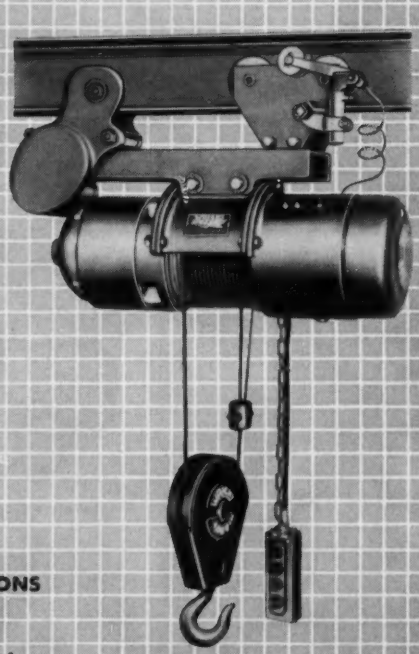
¼ TO 2 TONS
WRIGHT Electric
Roller Chain Hoist



¼ TO 1 TON
Speedway
Frame 1
Electric Hoist



1½ TO 2 TONS
Speedway
Frame 1½
Electric Hoist



½ TO 6 TONS
(Motor Driven Trolley)
Speedway
Electric Hoist

Whatever kind of gears you make...
Whatever way you make them

National Tool Co.

can supply the right type cutting tool
because we make *all* types

Gear Shaving Cutters

Hobs

National Tool Co., with 50 years experience in the manufacture of special cutting tools, makes *all* varieties of gear cutting tools for *all* types of spur, helical and worm gears—as well as for sprockets and splines. Whatever your gear requirements—large or small—National engineers can help you decide the most efficient method of producing them. Many gear manufacturers have found it profitable to look to National Tool Co. for all their gear cutting tool requirements.

Rack Type Gear Shaper Cutters

Gear Shaper Cutters

Involute Gear Cutters

Master Gears

Herringbone Gear Cutters

1905 • 1955
Our 50th Year

National
TOOL CO.
Cleveland 2, Ohio

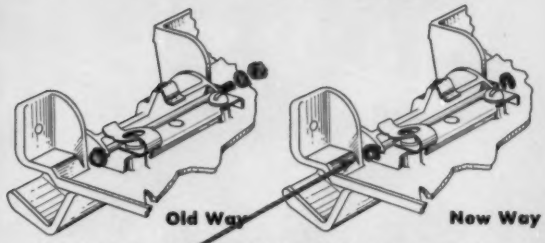
Representatives in major industrial centers

5 Waldes Truarc rings eliminate parts, speed assembly, in light, compact dictating machine

Edison's "V. P." Voicewriter

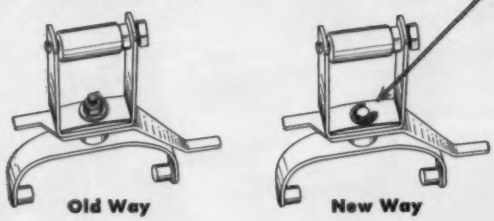
Edison engineers built this new dictating instrument for small size, light weight, and rugged performance. Waldes Truarc rings replace old fashioned fasteners, cut production costs; keep unit light, compact, and achieve faster more economical assembly.

Disc Lever Cover Assembly



Two Waldes Truarc E-Rings (Series 5133) replace nut, bolt, washer assembly, eliminate one component and assure precise alignment of parts. Truarc rings facilitate pivoting without binding. Production assembly time is decreased.

Lift Bracket and Fork Assembly



A single, easily assembled Waldes Truarc E-Ring (Series 5133) replaces nut-bolt-washer fastening. Free pivoting is assured, one component eliminated, labor and material costs reduced.

Clutch Plate Assembly

Two Truarc E-Rings eliminate staking operation, prevent damage to spring coil. Simple assembly operation speeds production, eliminates rejects, reduces labor and material costs.

Whatever you make, there's a Waldes Truarc Retaining Ring designed to improve your product... to save you material, machining and labor costs. They're quick and easy to assemble, and they do a better job of holding parts together. Truarc rings are precision engineered and precision made, quality controlled from raw material to finished ring.

36 functionally different types... as many as 97 different sizes within a type... 5 metal specifications and 14 different finishes. Truarc rings are available from 90 stocking points throughout the U. S. A. and Canada.

More than 30 engineering-minded factory representatives and 700 field men are available to you on call. Send us your blueprints today. Let our Truarc engineers help you solve design, assembly and production problems, without obligation.

For precision internal grooving and undercutting... Waldes Truarc Grooving Tool!

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TRUARC®
RETAINING RINGS

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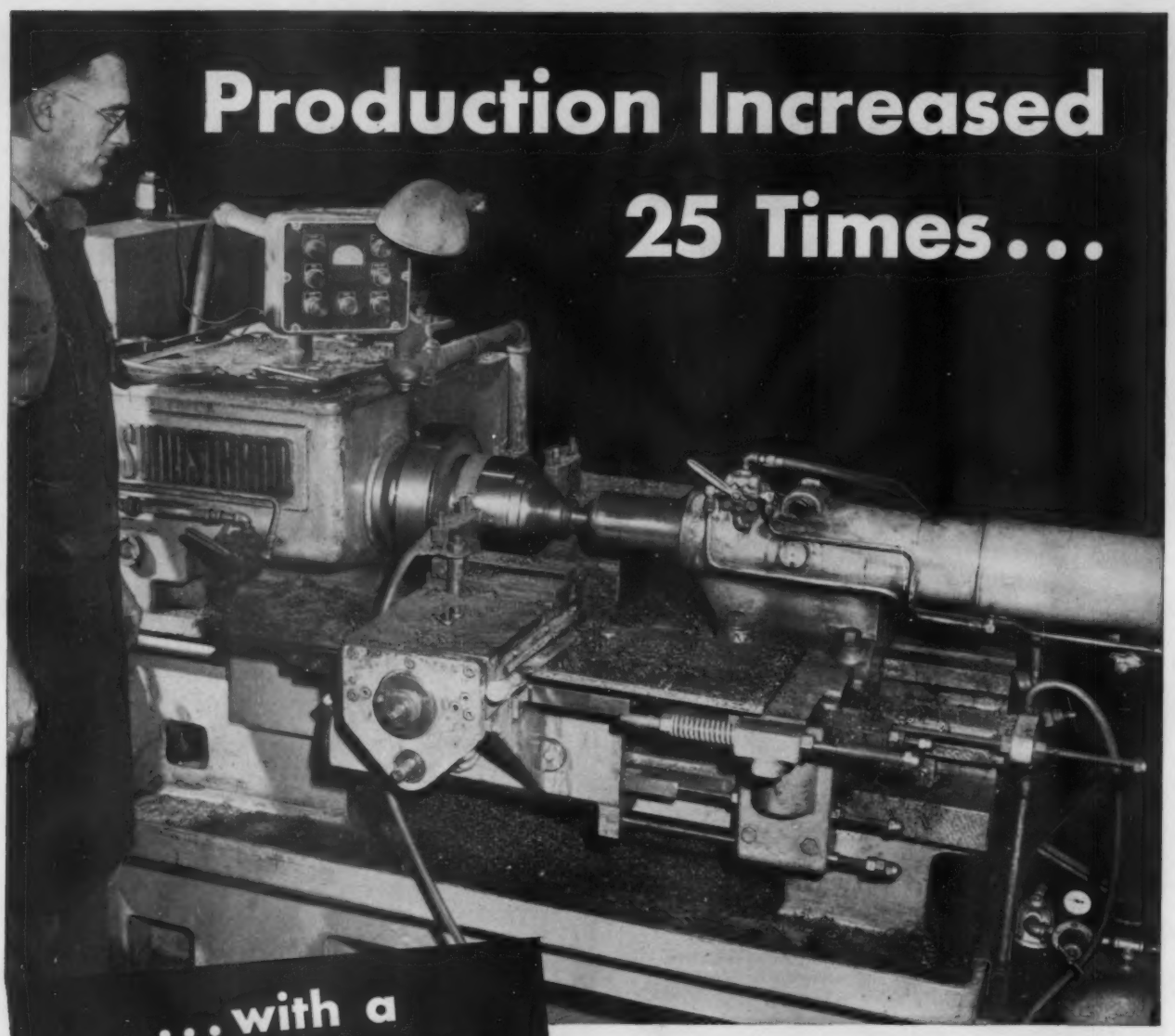
Waldes Kohinoor, Inc., 47-16 Austel Place, L. I. C. 1, N. Y.
Please send the new supplement No. 1 which brings Truarc Catalog RR 9-52 up to date.
(Please print)

Name.....
Title.....
Company.....
Business Address.....
City.....*Zone*.....*State*.....

A 56077

WALDES TRUARC Retaining Rings, Grooving Tools, Pliers, Applicators and Dispensers are protected by one or more of the following U. S. Patents: 2,382,948; 2,411,426; 2,411,761; 2,416,852; 2,420,921; 2,428,341; 2,439,785; 2,441,846; 2,455,165; 2,483,379; 2,483,380; 2,483,383; 2,487,802; 2,487,803; 2,491,306; 2,491,310; 2,509,081; 2,544,631; 2,546,616; 2,547,263; 2,558,704; 2,574,034; 2,577,319; 2,595,787, and other U. S. Patents pending. Equal patent protection established in foreign countries.

Production Increased 25 Times...



...with a SUNDSTRAND Automatic Lathe

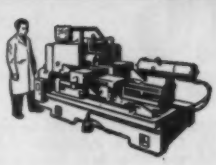
A. O. Smith Corporation increased production of stator core assemblies over 25 times with the installation of a Sundstrand Model 8A Automatic Lathe. These stator core parts, which are of silicon-iron laminations, have the outside diameter turned and the ends chamfered. With the previous method, tool life was short and the parts required a ruff and finish cut to obtain the desired accuracy and finish. With the Sundstrand Automatic Lathe and tooling method only one cut was necessary to obtain the desired finish and accuracy, while greatly increasing the rate of production.

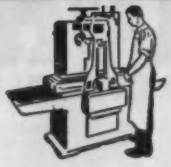
SUNDSTRAND

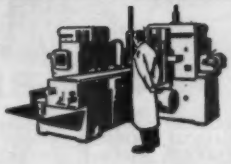
50 YEARS OF "Engineered Production" Service*

REG. U.S. PAT. OFF.

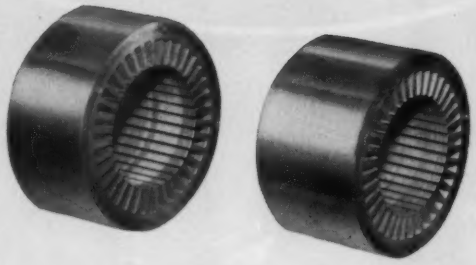
AUTOMATIC LATHES | SIMPLEX RIGIDMILS | DUPLEX RIGIDMILS

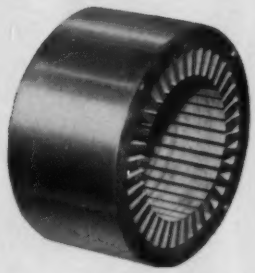






Job Data





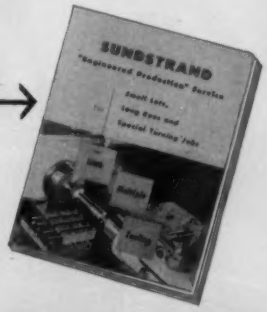
Eight sizes of stator core assemblies are turned on the O. D. and chamfered on the ends. Parts are silicon-iron laminations ranging in size from 7½" to 8¾" in diameter and from 3½" to 6" in lengths. Lot sizes vary from 300 to 400 pieces.

When you want Production at lowest cost use SUNDSTRAND "Engineered Production" Service

Production increases and savings like these shown for A. O. Smith are not unusual with Sundstrand Automatic Lathes. Investigate their possibilities for your work. A Sundstrand engineer will be glad to make an "Engineered Production" analysis. There is no obligation for this service.

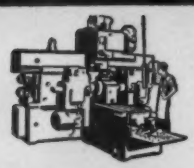
See the new and improved Sundstrand machines in action in BOOTH 1412.

Additional Data



on the complete line of Sundstrand Automatic Lathes is included in this new 32-page booklet. Write for your copy today. Ask for bulletin 157.

TRIPLEX RIGIDMILS | SPECIAL MACHINES



SUNDSTRAND
Machine Tool Co.
2533 Eleventh St. • Rockford, Ill., U.S.A.

NEW 13" REGAL

LE BLOND of Cincinnati

NEW 16" APRON

NEW 15" DUAL DRIVE

50" ROLL TURNING LATHE

NEW 32" SPINDLE

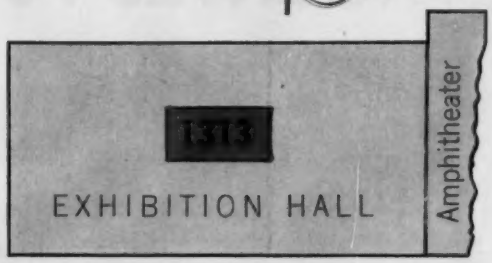
NEW HEAVY DUTY BED

NEW HEAVY DUTY TAILSTOCK

NEW 32" HEAVY DUTY

AT THE SHOW

We are extremely proud of the major design advancements you'll see at the LeBlond Exhibit—No. 1313, dead center in the new Exhibition Hall. You'll see 16 of the world's most modern lathes. You'll witness unique demonstrations in tracing, rapid boring and high-power turning. *Don't miss LeBlond!*



NEW 13", 15", 17" and 19" Regal Lathes

Famous for dependable performance at low cost, our Regals have been redesigned from the ground up! Biglathe features include — Combined gear and belt-drive headstock. Replaceable hardened steel bedways. Separate feedrod and leadscrew.

NEW 15" Dual Drive Lathe

Best buy in the medium-duty class, the new Dual Drive features 16 speeds from 30 to 2400 rpm through a combined gear and belt-drive headstock. 5 hp. Replaceable hardened steel bedways. Totally-enclosed quick change box.

NEW 16" Heavy Duty Lathe

Most popular of the heavy duties, our new 16" provides 27 speeds from 16 to 2000 rpm through a combined gear and belt-drive headstock. 20 hp. Four way power rapid traverse. Replaceable hardened steel bedways. Enclosed quick change box.

RT Toolroom Lathe

Even today, other lathes can't match the advanced designs pioneered by LeBlond in the RT. Universal QC box—90 feeds and threads. Automatic chasing stop. Combined feed apron with built-in taper attachment.

NEW 25" and 32" Heavy-Duty Lathes

Cut with confidence at high horsepower! New headstocks use heavy, short shafts; 4-bearing spindle; provide adjustable accelerations for starting, stopping, jogging. 50 hp on the 25", 60 hp on the 32".

NEW 32" Special Heavy-Duty Lathe

You'll see well over 100 hp actually used at the tool. Built for Carboloy to test the newest in carbide tooling, this special 32" uses a 125 hp, variable speed drive, provides speeds from 42 to 1400 rpm.

NEW 25"/50" Sliding Bed Gap Lathe

A brand new model of this most versatile of lathe designs. Headstock provides 36 spindle speeds from 6 to 625 rpm. Adjustable acceleration for starting, stopping, jogging. New bed increases stability, easy cleanout.

50" Roll Turning Lathe

See how huge steel mill rolls are contoured in less than half former time. Two-directional hydraulic tracing from a simple template. Feed and speed can be varied during cut without leaving a tool mark.

NEW Automatic Crankshaft Lathe

Fifty-five crankshafts per hour are turned on the fastest crank-turning equipment yet developed. Five main bearings, flange and pilot, sprocket diameter and front end turned simultaneously. Transfer is automatic.

NEW LeBlond-Carlstedt Rapid Borer

Entirely new concept in high production of deep holes. Designed expressly to accommodate the new boring method and tooling developed in Europe. Don't miss this demonstration — *see holes bored 3 to 8 times faster than ever before!*

... cut with confidence

THE R. K. LEBLOND MACHINE TOOL COMPANY

CINCINNATI 8, OHIO

LEBLOND *of Cincinnati*

World's Largest Builder of a Complete Line of Lathes . . . For More than 68 Years

FOR LARGE OR SMALL MACHINES... YOU'LL FIND DEPENDABLE FACILITIES FOR BUILDING "SPECIALS".

Designing a special machine tool is one task. Building the unit to meet production demands and to run day-in and day-out without costly shut-downs, is quite another matter — a good deal depends upon the proper facilities. The best of modern equipment and precision tools are required. That's why at Barnes, one of the best-equipped plants in the Midwest, you'll find complete and adequate facilities which make not only for efficient work, but provide the means for building better machines to meet high production goals and reduce costs.

Coordinated 6-Point Service at Barnes Saves Time

The complete machine tool building service at Barnes, you'll find, will help you solve problems quickly and efficiently. You get a complete machine all from one source because work is coordinated in one plant:

1 **SPECIALIZED MANUFACTURING FACILITIES** — 80 year background, large well equipped plant efficiently tooled to produce high production machines.

2 **SPECIAL HYDRAULIC EQUIPMENT** — designed and built to meet JIC standards. Individually engineered units assure smooth, dependable actuation for every requirement.

3 **SPECIAL GAUGES, FIXTURES, TOOLS** — designed for each individual machining problem, assure accuracy of operation at high production speeds.

4 **SPECIAL ELECTRICAL EQUIPMENT and CONTROLS** — individually designed and built for maximum safety and ease of control with circuits that assure the most dependable coordination of all machine functions.

5 **SPECIAL HANDLING AND CONVEYOR EQUIPMENT** — designed and built to reduce work handling, effect maximum safety and efficiency.

6 **COORDINATED DESIGN AND ENGINEERING** — Mechanical, Hydraulic, Electrical, Process, Tool, and Fixture Engineers work together at Barnes. Team-work solves complex problems quickly.

W. F. & JOHN BARNES

Special Machine Tools

Special Conveyor Units

Special Process Equipment

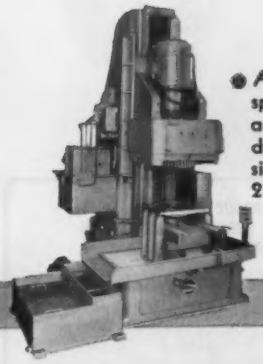
Builders of Better Machines and Equipment Since 1872

MULTIPLE SPINDLE DRILLING • BORING • TAPPING MACHINES

SEE US AT BOOTH 1233

. AT W. F. & JOHN BARNES

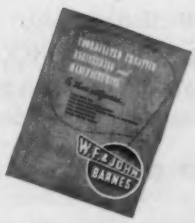
● Special W. F. & John Barnes 15-Station Automatic "Progress-Thru" Machine built for an automobile manufacturer for machining cylinder heads. A total of 78 machining operations are handled automatically at a gross production rate of 117 pieces per hour. The entire unit, including hydraulic and electrical circuits, designed for easy accessibility.

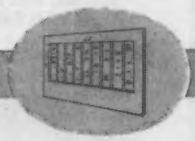


● A typical small multiple spindle machine designed and built by Barnes — drills 40 — .332" holes simultaneously. Produces 27 pieces per hour.

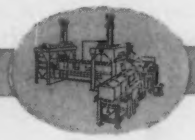
Write for Free Data

● Ask for free booklet "Coordinated Machine Engineering" describing the scope of Barnes machine tool building service. Illustrates and describes modern machines and mass production techniques.





Special Electrical Controls



Food Machinery

W. F. & JOHN BARNES COMPANY • 401 S. WATER STREET, ROCKFORD, ILLINOIS

AUTOMATIC PROGRESS-THRU AND TRANSFER TYPE MACHINES

What's Your Production Problem Today?

The 1955 Production PLANBOOK

Is Edited to Help You Solve It . . . Fast!

The 1955 Production PLANBOOK issue is your most valuable source of *proved* production methods: (1) it brings you in condensed form the best ideas from a full year's issues of *American Machinist*, and (2) this data is classified and indexed so that in seconds you can find the meat of the specific information you want to apply to your problem. Have you checked it lately?

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The PLANBOOK contains – for the first time any place – over 2,000 production "nuggets," (a compact file of "how-to-do-it" production methods) in ten thumb-indexed sections. Remember, only if you keep your PLANBOOK readily accessible for quick reference, can you convert this practical job information into time- and money-saving ideas. Review it again today.

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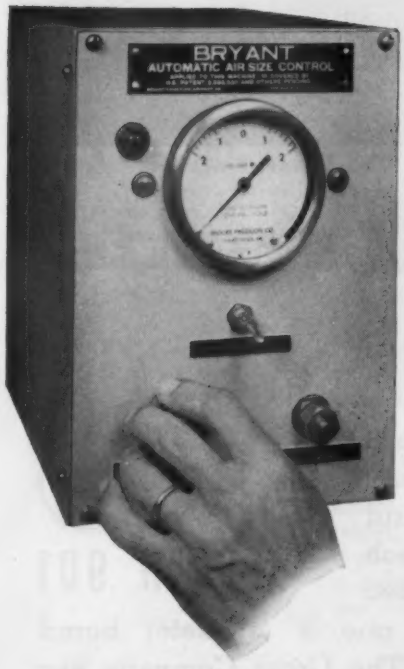
ABC ABP

NEW

BRYANT air sizing . . .

Bryant #2209-Y Automatic Internal Grinder equipped with Bryant Air Sizing for automatic size control of bores



holds closer tolerances in internal grinding than any other sizing method!

This new method of sizing is designed especially for automatic production. It's extremely accurate, time-saving and economical—ideal for straight hole grinding when high-speed production, close tolerances and fine finishes are desired.

Bryant Air Sizing utilizes three principal operating components: Air Gage Panel, Bryant Impulse Timer and the Air Plug.

The Air Plug is mounted through the workhead and traverses continuously into the workpiece during the finish grinding cycle. Oscillation is timed and controlled from the wheelslide.

The Air Gage Panel measures the pressure peaks which occur at the air plug orifices each time the Air Plug enters the workpiece. These pressure peaks are multiplied to make gaging faster and more sensitive, and are then converted from pressure values into electrical impulses which operate the Bryant Impulse Timer.

The Timer continues the grinding cycle until the impulse signals stop, indicating that size has been reached. It then stops the grinding cycle and initiates the automatic loading cycle.

Bryant Air Sizing controls the size of workpieces *during the finish grinding cycle*. There is no contact between the gaging element and the workpiece. As a result, wear of the gaging element and possible scoring of the workpiece is eliminated.

Diamond sizing is used with Bryant Air Sizing to control size during the rough grind operation. *Write for descriptive literature.*

Be sure to see Bryant at the Machine Tool Show, *Booth 1015*

BRYANT chucking grinder co.

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Offices: Indianapolis • Cleveland • Chicago • Detroit • Mt. Vernon, N. Y. • Philadelphia

Internal Grinders • Boring Machines • Internal & External Thread Gages • Granite Surface Plates

A close-up of the operation. Super Service Radials have the power for steady performance.

Photos courtesy The Cross Company, Detroit, Michigan.

a traveling "Super Service" does this LARGE AREA JOB . . .

Here at The Cross Company ten Cincinnati Bickford Super Service Radial Drills are at work . . . On this job, the traveling Radial with sliding base, saves time and gives high production with necessary accuracy. In each of the 7 bases handled here there are 20 holes drilled and tapped and one 3" diameter bored and chamfered. The Cross Company say these drilling machines "bring easy handling, dependability and durability."

THE MACHINE TOOL SHOW CHICAGO, ILL. SEPT. 6-17, 1955 INTERNATIONAL AMPHITHEATRE

BOOTH 901

Write for Catalog R-29.

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CINCINNATI BICKFORD

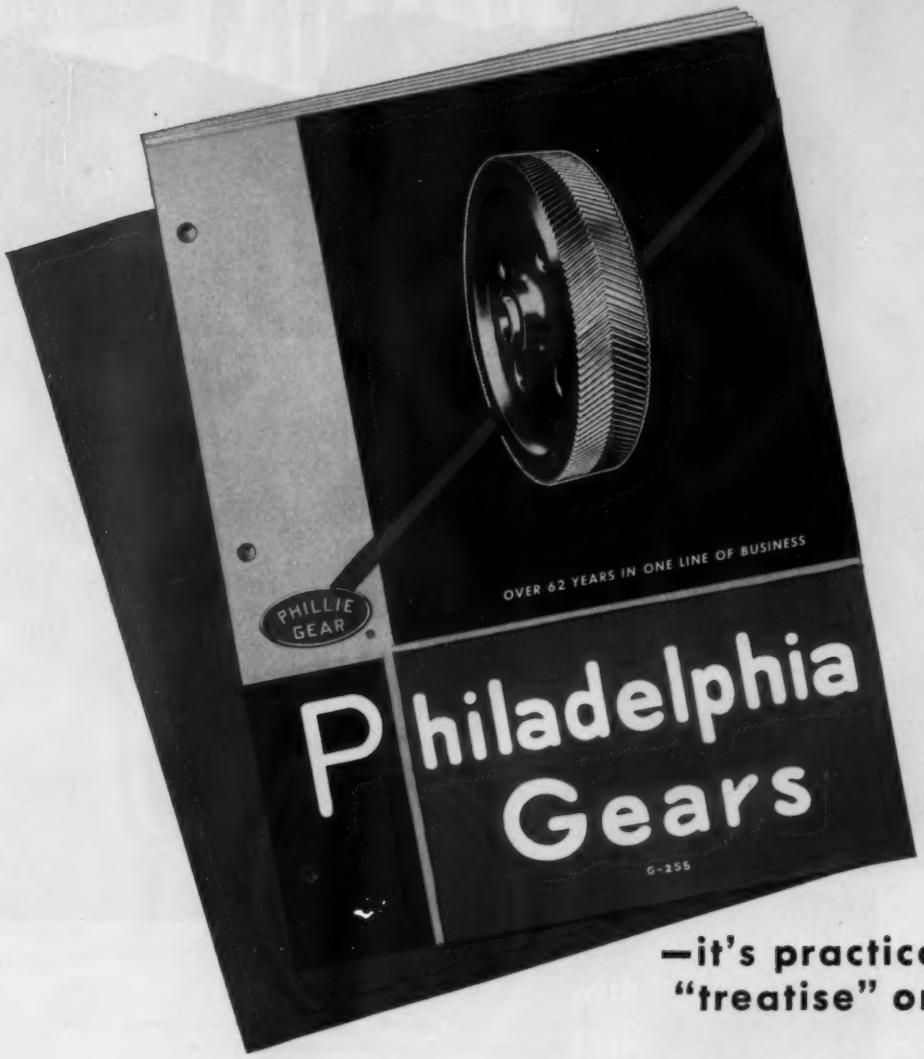
SUPER SERVICE

RADIAL AND UPRIGHT DRILLING MACHINES

THE CINCINNATI BICKFORD TOOL CO.

Cincinnati 9, Ohio, U.S.A.

NEW... *more than a catalog—*



—it's practically a "treatise" on gears

Never before, to the best of our knowledge, has so much helpful information been assembled between the covers of a gear catalog . . . 76 pages of illustrations, diagrams, definitions, tables, charts, and explanations regarding all types of gears. If you design, use or buy gears, you can't afford to be without a copy of this Book—so fill in coupon below for your copy of this valuable text.

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▲ L-M pond-type chain saws "bucking" log for a veneer plant.

◀ Close-up of MAX-EL alloy steel chain saw bar, showing depth of heat treatment for tougher, longer-lasting bars.

it takes MAX-EL Alloy Steel to take a beating like this

Ram the flying teeth of a chain saw against a heavy log – and watch the sawdust fly! But don't forget – backing up that speeding chain is a bar that has to absorb all the shock . . . yet keep the chain lined up accurately, dependably.

That's a big reason why leading chain saw manufacturers, like L-M Equipment Company, Portland, Oregon, specify Crucible MAX-EL® alloy steel for chain saw bars.

And there are other reasons, too. For MAX-EL is not only tough, wear-resistant and dependable . . . but it also shows outstanding response to heat treatment . . . excellent machinability . . . high uniformity . . . minimum distortion. It's these qualities that permit L-M to machine their saw bars first – *then* give them a graduated heat treatment that insures toughness at the edges . . . flexibility in the main section.

If your product requires a tough, machinable, non-deforming alloy steel – MAX-EL is for you. Try it. To see what information is available on MAX-EL – or *any* Crucible special steel – get your copy of the "Crucible Publication Catalog." Write *Crucible Steel Company of America, Henry W. Oliver Building, Pittsburgh 22, Pa.*

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The efficient Oliver automatically indexes and machine grinds each tooth in succession until the entire cutter is completely and accurately ground. The shape of the tooth is determined by inexpensive, easily replaceable, hardened cams.

The lasting accuracy of the OLIVER "AUTOMATIC" FACE MILL GRINDER is assured . . . at each stroke the wheel passes over a fixed diamond compensating for wheel wear. This unique Oliver feature enables tungsten-carbide and high speed inserts to be easily and rapidly ground to any degree of accuracy and quality of finish.

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Backlash

EXTRACTS FROM CURRENT LETTERS TO THE EDITORS

The Old V-6

The letter by Lew Suverkrop (*AM*—May 23 '55, p94) was particularly interesting because I worked with his Dad for many years on *AM*, and because I spent an evening with him in April of this year at his home.

Recently I saw one of the best-known Italian cars with a V-6 engine, the Lancia, which was bought for a tidy sum in my own home town. The only other V-6 I ever saw was in Detroit, many years ago, when someone whose name I have forgotten started to build a V-6 air-cooled engine. I was especially interested because I had been driving Franklin cars for some years. Incidentally, they were among the best I have ever had, and I've had quite a variety, from a Toledo steamer to a Lincoln Zephyr, not forgetting Metz friction-drive cars.

I never studied the problem of balancing the engines, but if Lew Suverkrop says the V-6 or the in-line 5 is easily balanced, I'll take his word for it. He's that kind of a guy.

This also recalls an engine design I saw years ago, of an in-line 6 in which one cylinder was a dummy. It was there because everybody thought six cylinders were necessary. The dummy was designed to carry the tool kit and extra spark plugs, which were then a part of every driver's spares (as well as a goodly supply of inner tubes). I still have the really good tool kit that came with my last Franklin. It was something to write home about. The nearest approach I've seen to it came with a new Mercedes-Benz and included a substantial case, spark plugs, and a distributor wiper arm.

Fred Colvin
Point Pleasant, NJ

Counting the Zeros

The suggestion by Lew Suverkrop (*AM*—May 23 '55, p94) for dimensioning drawings with ultrafine measurements seems to have a lot of merit. As the editorial comment says, this looks like a really good suggestion. Anything that will help us get the right dimensions from a drawing is to be commended. It is all too easy to be confused when you see more zeros than usual. Even when the dimensions are not intricate, mistakes do happen, and they all cost money

GRINETICS

By D G SMITH

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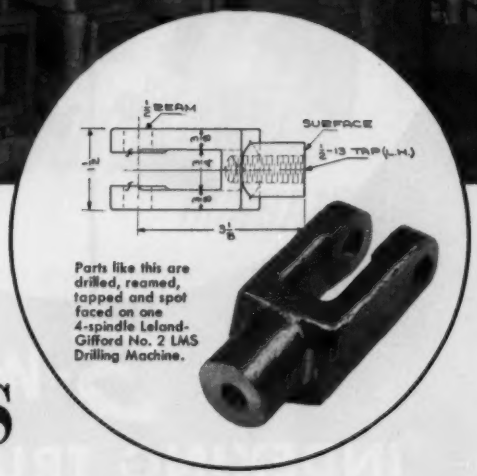
SURFACE
Parts like this are drilled, reamed, tapped and spot faced on one 4-spindle Leland-Gifford No. 2 LMS Drilling Machine.

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Builders of packaging and bottling equipment known the world over for smooth precision and fast work flow, Pneumatic Scale Corporation, Ltd. looks for the same advantages when choosing equipment for its own shops. They use Leland-Gifford Multiple Spindle Drilling Machines to keep costs low, quality high . . . handling precision drilling, tapping, reaming, spot facing and similar operations in any sequence or combination on one machine with the right tool for the job always ready for instant use.

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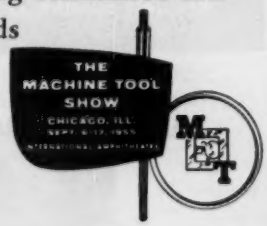

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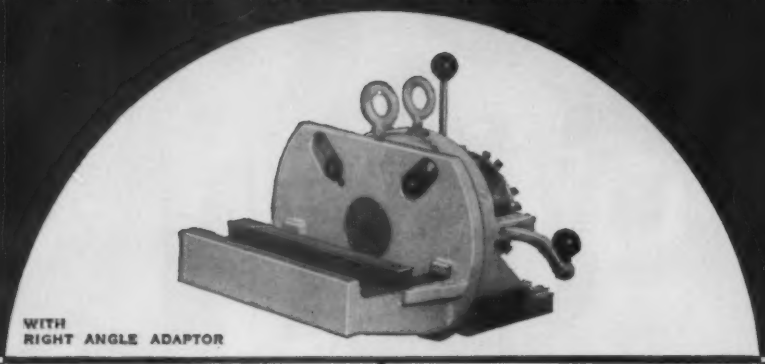
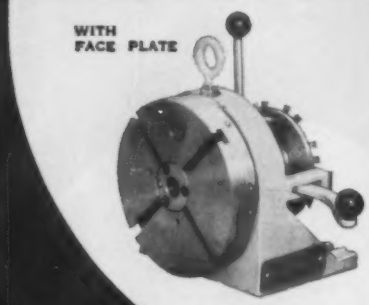
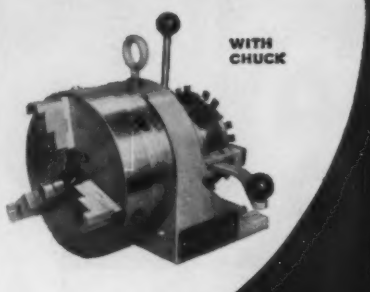
"...one of the most useful pieces of equipment in metal working plants throughout the country."



WITH RIGHT ANGLE ADAPTOR



WITH FACE PLATE



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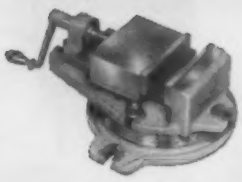
Gives new, *simple* mounting of work or jig plus rapid, controlled rotation to correct angular positions. Used on radial drills, boring mills, planers, milling machines, and sensitive drills.

This is a basic, versatile production unit which speeds up multiple same-piece operations on either long or short runs.

Request Bulletin J7 for complete details.



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PRODUCTION TOOL DIVISION

WORCESTER, MASSACHUSETTS

when translated into hard cash expended for materials and labor.

Fred Colvin
Point Pleasant, NJ

Attention Movie Makers

An interesting item in the contents of AMERICAN MACHINIST is the description of new films. We understand that it is a usual practice among machine tool manufacturers to produce films describing new machines, equipment, production features, etc.

Are any of these available abroad (through USIS in Milan, for instance)? If there is any opportunity of seeing them in Italy, we should be happy to take advantage of it.

D Nunes-Vais
Milan, Italy

If any of our many excellent industrial movies can be made available abroad, the producers might be well advised to offer them to the Unione Construttori Italiani Macchine Utensili, Via Gaetano Giardino, 4, Milan, Italy.—ED.

Bicycle Business

I have read with interest your comments on the toughness of the decision that your President Eisenhower has to make regarding import duty on bicycles (*AM*—April 11 '55, p 91) but, from over here, the issues look relatively clear.

The US has been preaching ever since the war that countries must reduce tariff barriers and assist each other in inter-trading; furthermore, it was behind the formation of GAT which allows for no increases of existing tariffs but encourages reductions. Although it is a misfortune that the US finds it so difficult to carry out this advice herself, surely here is another opportunity where she can set a fine example.

The US has been most proud to proclaim to the world its vast industrial superiority in know-how and general production methods. It is, therefore, most difficult to see why any section of its mighty industry

can fear competition. As Britain appears to be the main importer of bicycles, there cannot even be a claim of dumping or unfair competition.

It seems that if the US bicycle manufacturers do need protection then, presumably, it can only be because they are out-produced, out-designed, out-dated and out-priced, and instead of crying for help and protection they should look to their laurels and make themselves efficient.

G R N Sperryn
Birmingham, England

Southern Exposure

Associate editor Jim Linsley recently made a trip to North Carolina, specifically to address the ASTE chapters in Charlotte and Raleigh, but also to take a closer look at what the Tar-Heels are doing in the metalworking field. You'll hear more about that in a forthcoming issue. Needless to say, he fell into the common trap of kidding his hosts about their use of "y'all." A few days later he received from Sid Jeffreys, Jeffreys Engineering & Equip't Co, Greensboro, the following:

"You All"

Come all of you from other parts,
Both city folks and rural,
And listen while I tell you this:
The word "you-all" is plural.

When we say "you-all" must come down,
Or we-all shall be lonely,
We mean a dozen folks, perhaps,
And not one person only.

If I should say to Hiram Jones,
For instance, "You-all's lazy,"
Or, "Will you-all lend me your knife?"
He'd think that I was crazy.

Now if you'd be more sociable
And with us often mingle,
You'd find that in the native tongue,
"You-all" is never single.

Don't think I mean to criticize,
Or act as if I knew all,
But—when we speak of one alone,
We-all say "you," like you-all.

Author Unknown

for Special Service on Carbide "Specials"

GORHAM

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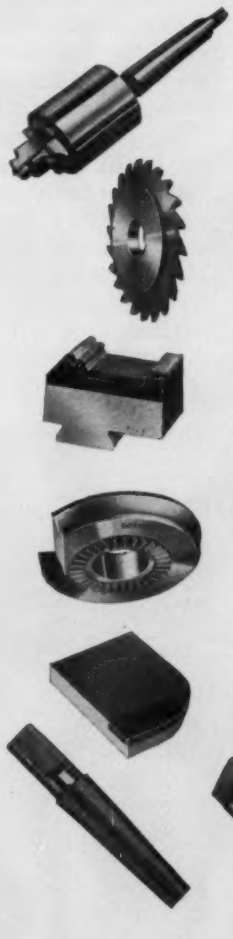

When your production machining problem dictates the use of special carbide tooling, your nearby Gorham Field Engineer can give you the right answers fast! He's an expert in the design and application of special cutting tools . . . and he provides a complete engineering service to determine your exact requirements.

He begins with your product, sketch or idea. He surveys your production operations and available equipment. He considers work material properties and required finishes and tolerances. He plots speeds, feeds and methods of tool driving. Then he develops practical design and metallurgical specifications for a special tool that's "tailor-made" for your application. And his recommendations are backed by Gorham's more than thirty years' experience in the design, manufacture and heat treatment of fine cutting tools.

Yes, your nearby Gorham Field Engineer is a helpful man to have around! If you haven't yet met him, write for his name, or send details of your problem direct, and we'll have him get in touch with you promptly.

Gorham TOOL COMPANY

"EVERYTHING IN STANDARD AND SPECIAL CUTTING TOOLS"

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WEST COAST WAREHOUSE: 576 North Prairie Ave., Hawthorne, Calif.

50-ton crane becomes 85-ton crane

with no increase in size

United States Steel's Edgar Thomson Works in Braddock, Pennsylvania, needed new and heftier crane equipment to handle larger ladles. One of the requirements was four new crane trolleys which were to operate on the same bridges, if possible, and in exactly the same clearances as before.

The trolleys had to be stronger but no larger than before; so ordinary steel wouldn't do. Needed, was a steel of *exceptional strength* which could be *welded easily*. Lots of alloy steels could have met the strength requirements; but USS "T-1" Steel was the *only* steel that could supply not only the required strength, but good weldability as well.

"T-1" Steel plate—in ¾" and 1" thicknesses—was used in box girders and lateral stiffener plates of the trolleys. This change increased the crane capacity from 50 to 85 tons with no increase in size.

The structure was welded with AWS E12015 electrodes. It was as easy as welding carbon steel. No stress relief was needed. And the welds developed the full yield strength of the steel: 90,000 psi. minimum.

Remember this story when you must weld very high strength parts—parts that must operate at temperatures as high as 900°F. or as low as 40°F. below zero, parts that must withstand tremendous impact abuse, abrasion, or tensile stress. Then consider USS "T-1" Steel. We'll gladly send you full particulars. Just write to United States Steel, Room 4764, Pittsburgh 30, Pa.

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USS "T1" CONSTRUCTIONAL ALLOY STEEL

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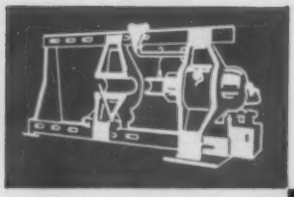
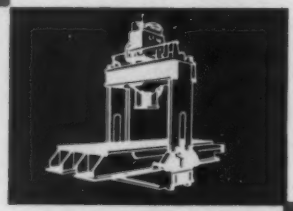
Elmes...

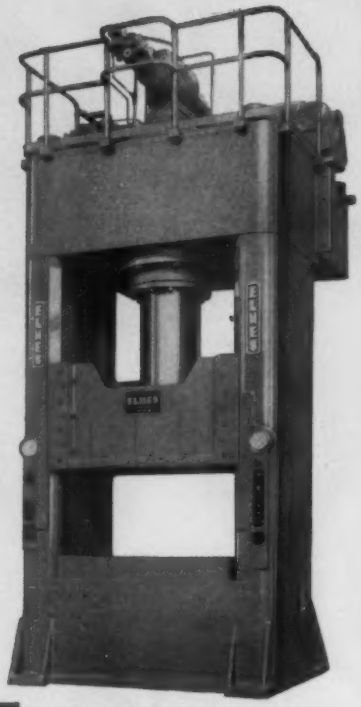
builds hydraulic metalworking presses to meet *your* production requirements—exactly



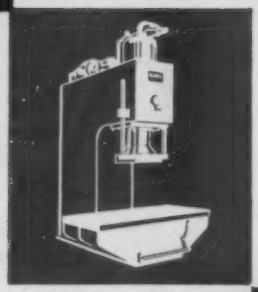
Inclined Forcing



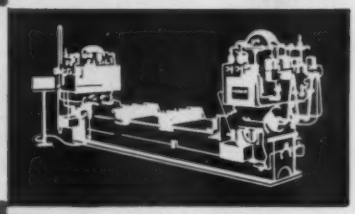
Traveling Head Straightening



Drawing and Forming

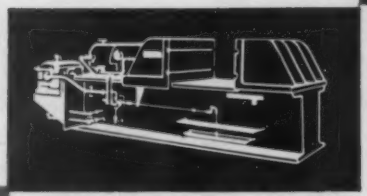


Openside C-Frame



Tube Reducing

Hobbing



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If you're seeking improved and more economical press performance for your metalworking production, you can come with confidence to Elmes. Elmes builds a complete line of hydraulic presses for a broad range of metalworking jobs—for drawing and forming, coining, forging, hobbing, straightening, bending, forcing, powder metal compacting, etc. One of the many Elmes® standard press designs may fit your needs exactly. Or, if your requirements are special, you can rely upon Elmes "custom engineering" for the answer. Building presses to meet individual customer requirements is an important part of Elmes engineering service.

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Spot News of Metalworking . . .

Armour Research Foundation's "Flame Spray" process for coating metals, glass and ceramics with powdered ceramics fed through a flame gun has been licensed commercially on an exclusive basis to Continental Coatings Corp of Illinois, Chicago, for sub-licensing.

How to machine radioactive bars into a form applicable for peacetime use is one of the projects in a $100,000 industrial atomic power study to be made by the Ford Motor Co. Ford scientists will try to develop ways of producing these bars at low cost. Radioactive bars make the atomic reactor perform.

A 61-cent cut in hourly wages is being taken by foundry workers of Eaton Mfg Co in effort to keep the company's Vassar, Mich, plant from closing permanently. Average hourly wages, after the cut, still will be $2.06.

Wondering when the guaranteed annual wage is going to come up at non-auto metalworking companies? Not for quite a while, experts think. Prime reason is the wide dispersal and variety of metalworking plants. IAM President Al Hayes, for instance, says his union would have to bring up the question at hundreds of different bargaining sessions all over the country—unlike UAW, which can concentrate its demand on a few major firms.

British shipbuilding is "too slow and too dear." That's the reason given by a British shipping firm that has ordered three out of four new ships to be built in German yards. The firm would have given the fourth order to Germany, too, but the Germans were too busy to take it on.

Help to government contractors on radio-interference specifications is now available in a 270-page manual just published by the Office of Technical Services, U S Dept of Commerce, Washington. The price is $6.75. Manual gives information on approved suppression components and systems, and tells how to get help from the Signal Corps in solving specific problems.

Replacement of 3496 obsolete machine tools with 2474 new machines of today's design will save Navy's 11 shipyards 3099 manyears annually, in case of mobilization, Bureau of Ships study shows. For detailed story on Navy replacement program, turn to p156.

Color-coded controls are the best way to overcome operator confusion in this day of highly complex machines. That's the conclusion drawn from extensive studies made by Pittsburgh Plate Glass Co's Color Research Laboratory. Proof? Color coding cut time required to learn aircraft control operation 35% over such other methods as shape and letter identification.

38,000 new freight cars have recently been added to backlogs of railroad car builders, bringing total on order to 55,000 cars costing $45 million. Stepped-up program of car repair and upgrading has been announced by nation's railroads.

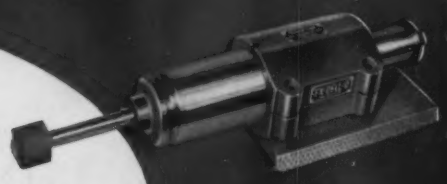
Number of Chicago tool and die shops have been closed by strike of AFL tool and die makers' union members who are asking 10-cents-an-hour increase and who refuse to deal with the Chicago Tool and Die Institute's bargaining committee. Average hourly rate now paid is $3.05.

In-plant training should be accreditable toward engineering degrees. That's the opinion of Illinois Tech's R C Kintner, speaking before the American Society for Engineering Education: "There is no reason to penalize an employee working toward an advanced degree because he took a company course. He should not be made to repeat the course in a college classroom and be bored."

There's an EX-CELL-O

Precision Spindle

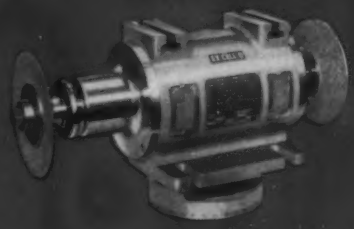
BUILT ESPECIALLY FOR YOUR WORK



Single-body, belt-driven internal grinding spindle.

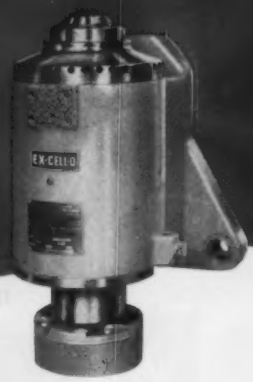
25 hp heavy duty precision spindle with 24" grinding wheel.

25,000 rpm high frequency inbuilt motor spindle.



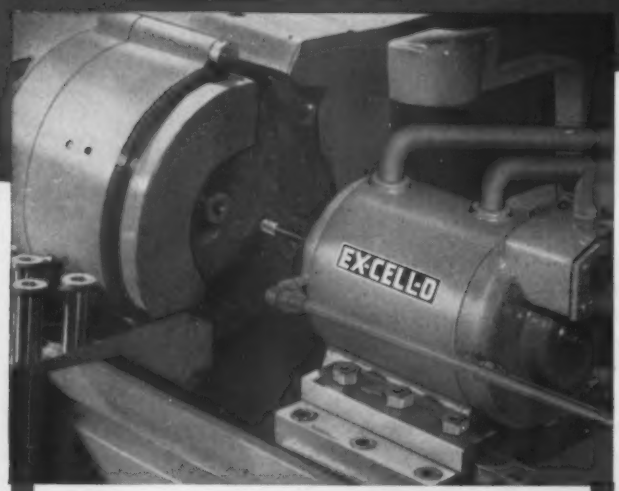
Precision inbuilt motor spindle for cutter grinder.

Totally enclosed inbuilt motor surface grinder spindle.



Heavy duty motorized precision spindle available up to 20 hp.

MACHINE TOOL
AUG. SEPT. 6-17
BOOTH 1319



EX-CELL-O High-frequency Spindle, rated at 40,000 rpm, grinds small holes in bushings.

XLO
EX-CELL-O for PRECISION

For production grinding to precision limits "just any spindle" won't do. It must be carefully selected to suit the work. From Ex-Cell-O's widely-varied line of precision spindles you can select a standard model, or we'll make one special to your requirements. These spindles have long been the original equipment choice of leading manufacturers.

Features of the line include:

Rigidity
Permanent adjustment
No vibration, no chatter
Precision ball bearings preloaded for predetermined speeds

Phone your Ex-Cell-O representative, or phone or write Ex-Cell-O in Detroit, for CATALOG LISTING HUNDREDS OF STANDARD GRINDING SPINDLES

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Washington . . .

Boost for Shipbuilding . . .

Shipbuilding industry is in for a big boost from government spending. Congress has pending a $102.8-million program for fiscal 1956. Reason for the big government budget for new ships: shipbuilding in private U S yards is at the lowest ebb since World War II. With only 20 ships now under construction, U S yards have reached an all-time low in employment on merchant ships, dropping to 4500 workers in April. Only a couple of years ago, yards had about 23,000 men on merchant ships.

Last year the government launched the biggest peacetime shipbuilding drive in history. Government orders or subsidies were approved that will produce over $400-million worth of new orders in shipyards. On top of this comes the new appropriation, to which industry is expected to add about $150 million.

Here's a breakdown on what the various government shipbuilding programs should mean dollar-wise:

● **With last year's program just taking hold,** combined 1955-56 expenditures may hit $661.5 million for construction of about 80 ships. Twenty new ships or conversions are now under way ($148 million); 36 will start by December ($320 million); 24 will start in 1956 ($183.3 million).

● **Another lift to shipbuilding** will come from obsolescence. About 80% of the current operating merchant fleet will be 20 years old by the mid-1960's. Theoretically, this makes them obsolete. If they are all replaced, the shipyards will overflow. Although all ships reaching the 20-year mark will not be immediately replaced, there'll be enough new building to prompt some government needling for shippers to start replacement before the rush. Lately, Congressional committees have tried to work up a solution to get this replacement construction started early.

Defense Production Act Renewal . . .

Extension of Defense Production Act will go through handily. The law provides priority and allocation control on materials and authorizes government incentives to expand defense-related capacity. The law will be renewed pretty much the way it stands.

The administration does not want standby price-wage controls. Only important amendment proposed: a 20-year exemption from anti-trust laws for firms pooling knowledge and facilities for defense production. As the law stands now, immunity is granted only during the life of the act.

New Deal Democrats oppose the extended anti-trust exemption. Defense officials say it is needed to expedite production. The exemption has been used by firms producing B-47 bombers, F-84 fighters, and components for the planes; also, J-47 jet engines, Navy guided missiles and fire equipment.

"WOC's" Knocked . . .

The government's "dollar-a-year" men—or WOC's—are under fire again. Sen Morse thinks the WOC system has been abused, that some WOC's may have used their government service for personal advantage or for the benefit of their companies. Hundreds of metalworking executives have served as WOC officials since 1950, mainly in DPA, NPA, and BDSA.

Morse is a member of the Senate Banking Committee, which is considering the extension of the Defense Production Act, under which WOC employment is authorized.

At his direction, ODM is working up a list of all businessmen who have worked in mobilization agencies since Korea without compensation. It will show government jobs held, private positions, and —most important—changes in private employment following temporary government service.

B-52 Step-Up . . .

B-52 output under the new stepped up program won't really increase for another year (see p155). An extra shift at Boeings' Seattle plant may boost production some, but the big increase is supposed to come from the firm's Wichita plant. That plant is tooled up almost entirely for B-47's.

Tax Policy Study . . .

Over the next five-and-a-half months, a group of prominent tax experts will make the most thorough study ever made of the economic effects of U S tax policies. The study is being made for Congress, and is bound to be an important factor next year when Congress will consider big tax cut proposals.

The tax experts have been organized into panels. Among the subjects: tax treatment of depreciation, capital gains taxation, impact of expanding and contracting the tax base, taxation and small business.

The experts' assignment is to find out what taxes really do to the economy—how they help or hinder economic growth. This stress on economic impact of taxes makes the study unique, Congressional sponsors of the study claim.

The study will get into such difficult questions as how much tax a man will pay before he loses the incentive to produce, whether corporations should be taxed at all on their income, and whether we can have economic growth without inflation.

The experts' findings are expected to guide Congressional tax writers for years to come. One issue that will get special attention: What are the side effects of the faster depreciation granted in the Revenue Act of 1954? Are there harmful effects which should be considered along with the favorable expansion of investment? Some economists think there's something still unknown in this area.

The man who needs a new machine tool and doesn't buy it is paying for it anyway...

in obsolete techniques

How can you tell when a machine or a process is obsolete?

Suppose you buy another machine of the same model that has been doing a satisfactory job. Do you know whether a different, more recently developed machine tool would do your work more accurately, faster, cheaper?

There is one sure way to keep up on developments and improvements—talk frequently to machine tool builders. Discuss your problems with their field engineers. It is their business to help you—to give you the benefit of their specialized experience.

Take Microhoning*, for example. Each year sees tremendous strides in applying this low-velocity abrading process to the problems of industry, through new machines and new techniques developed as new problems arise. Micromatic maintains the world's largest staff of honing specialists and has been responsible for every major development in honing in the past 25 years.

So if you're not in close touch with our representatives as well as with other tool engineers, you may be paying now, in obsolete techniques, for the new machine tools you don't have.

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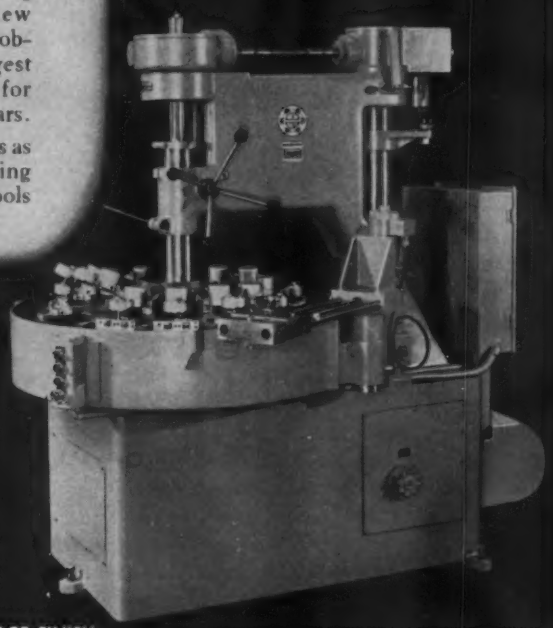

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Detroit . . .

Off the back burner . . .

General Motors customarily keeps a tight lip during labor negotiations. It has little to say about anything while working up a new labor contract. That's why you didn't hear earlier about the $500 million GM is throwing into another expansion program. Announcement in May or early June would have given Walter Reuther just that much more to talk about. Auto executives are generally agreed that he talks all right on his own, without any help from them.

So GM sat on its latest financial story until a few reports began to drift through industry circles, then it released the barest details: about 6.3 million sq ft of new floor space will be built, but the major portion of the money will go for new machine tools and presses.

AM has been told that about one-fifth of the new money outlay will go to Buick, which plans to boost annual capacity to about 1 million units (*AM*— June 6 '55, p109). Ivan Wiles, Buick general manager, said bulk of his division's share of the money will buy new machines and tools; only construction planned will be an addition to the Flint engine plant to provide room for a third process line, and an office building addition. Buick alone will doubtless spend over $90 million for new machine tools and related equipment.

Fisher Body's share, it's known, will run somewhere beyond $60 million.

This new expenditure . . .

. . . runs the total that GM has spent in the U S and Canada since WWII to $4 billion. That doesn't include the huge outlays for special tools during that period.

GM's half-billion does not match Ford's recently announced $625-million expansion, but it keeps the world's biggest manufacturing concern well ahead in the post-WWII totals. Since 1946, Ford has committed $2.3 billion to expansion. Recently announced programs: acquisition of 193 acres of land in Sharonville, Ohio, for use as site of automatic transmission plant; additions to stamping plants in Buffalo, and Walton Hills, Ohio, not yet announced: a new manufacturing plant and office building for the Lincoln Division, to be located in the Detroit area.

You need look no farther for reasons why the Justice Dept and other such interested parties are peering at the auto industry. The total sums spent for expansion by Chrysler, Studebaker-Packard, American Motors and Kaiser-Willys over the same period are almost inconsequential when compared to the more than $6.3 billion the industry's pair of behemoths have programmed. As an example of what the expansions can mean: by 1957, it's believed, Ford's straight-time productive capacity — cars and trucks — will be up to 12,000 units daily. Current rate: about 9,000.

While big labor and big business . . .

. . . were making big noises in Detroit, about 535 employees of Eaton Manufacturing Co's Foundry Division in the village of Vassar, 80 miles north of Detroit, were slightly on the subdued side. Reason: they had voted to take a 61¢ an hour cut in pay.

The AFL (CQ) United Auto Workers had run the average pay scale in the Vassar foundry up to a fat $2.67 an hour. The area average: $2.05. Faced with a threat by the company to shut down the foundry for good, the workers readily agreed to the wage reduction.

Atomic energy talk . . .

. . . is popping up in the auto industry, stimulated largely by GM's announcement that Dr Lawrence Hafstad, former director of the AEC's Division of Reactor Development and presently director of the Atomic Energy Division of Chase Manhattan Bank, would become director of GM research, succeeding Charles McCuen, who will retire later this year.

Hafstad's appointment would seem to signal a definite interest by GM in development and application of atomic power for industrial and transport purposes. (GM's Electromotive Division possibly has initial interest in atomic energy inside the corporation. Its railway powerplants would be most logical users.)

Oddly, GM, which is three- or four-deep in management teams in virtually all its operations, had to go outside the corporation for a pure research man.

The atom is getting more attention from Ford, too, which is undertaking a $100,000 study of atomic power industrial applications, in cooperation with AEC. Says a spokesman: "As a major consumer of industrial power and as a mass fabricator of automotive power plants, Ford has a vital interest in all new energy sources, including nuclear energy."

One of the '56 cars . . .

. . . incorporates a novel steering wheel design. It's built so that the wheel will absorb body impact, in case of collision, thereby preventing the driver from being impaled by steering column.

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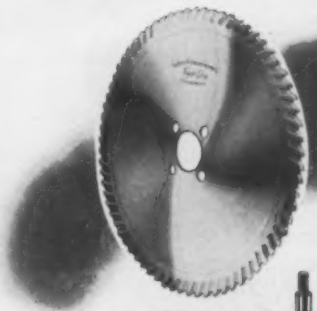

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Machine Tools . . .

Sharp rise in new orders . . .

New orders for machine tools shot up in May to $72 million, the biggest volume since 1953. They represented a gain of almost $20 million over April.

They exceeded shipments by more than $19 million. They were 71% higher than in the corresponding month a year ago.

The machine tool industry has booked $310 million of new business this year (January-through-May).

That is in contrast with $232 million in the same period of 1954. 1955 new orders have been at an annual rate of almost $750 million.

It is a pleasurable fact that orders have run ahead of production thus far this year by $45 million.

There is good reason to believe that June too was a good month for new machine tool orders. And the summer months appear likely to add substantially to order books.

General Motors to place big orders . . .

Detroit still is the chief support for machine tool business and will continue so in the coming months.

General Motors, for one, has announced a huge plant expansion program. Most of the money will go for new production equipment. For details, turn to p—.

GM's aim is to enlarge its manufacturing facilities so that the anticipated demand for its cars can be met by operating on a 40-hr week. Overtime is getting to be more and more costly as labor rates and fringe benefits go skyward.

Buick and Oldsmobile are reported to have placed sizable machine tool orders as a starter on their expansion programs.

Air Force orders reserve tools . . .

The first $11 million of the Air Force's $84 million reserve machine tool program has been awarded.

The bulk of the first allotment went for spar milling machines. Farnham got an order for 30 ($6 million) and Onsrud for 18 ($4.7 million).

21 of Farnham's machines will be 78 ft long, each with single carriages, and nine will be 104 ft long with double carriages, The 30 machines will require 99 beds, each 26 ft long, all of them interchangeable so that any carriage or combination of carriages could be run on any bed or combination of beds. Each carriage will have 2-4 milling heads and a 60-to-100 hp motor.

All the spar millers, however, have not yet been placed. Colonial Broach and Lapointe have contracts for broaching machines, the former for $193,000 and the latter for $245,000.

An additional $50 million is expected to be contracted for by September. In fact, some $15 million should be ordered between now and the end of July.

Skin millers to be bought soon . . .

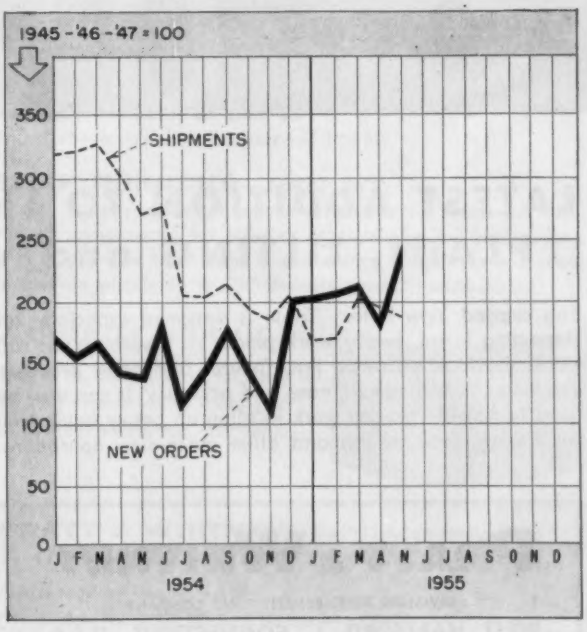
Skin milling machines are reported to be next on the list of machines to be bought. Competition for this business, incidentally, is even keener than for the spar millers.

Stretch presses might be bought before skin millers. If so, a lion's share is likely to go to Hufford.

Air Force is eager to see that a certain midwest builder gets some of the skin or spar miller work because of the company's extensive experience with tracer-control units.

Initial orders for reserve machine tools thus came from the Air Force 4-5 months later than expected.

Fortunately Congress has authorized the Defense Department to use in fiscal 1956 (starting July) the unobligated portion of its first $100 million reserve tool fund.



SHARP RISE IN MACHINE TOOL NEW ORDERS was recorded on the May National Machine Tool Builders Association Index. Orders jumped from April's 1955 low of 180.8 to 244 (1946-47 = 100) in the biggest single rise since that of November-December 1954. Shipments, however, stayed almost exactly even with the April figure of 180.8

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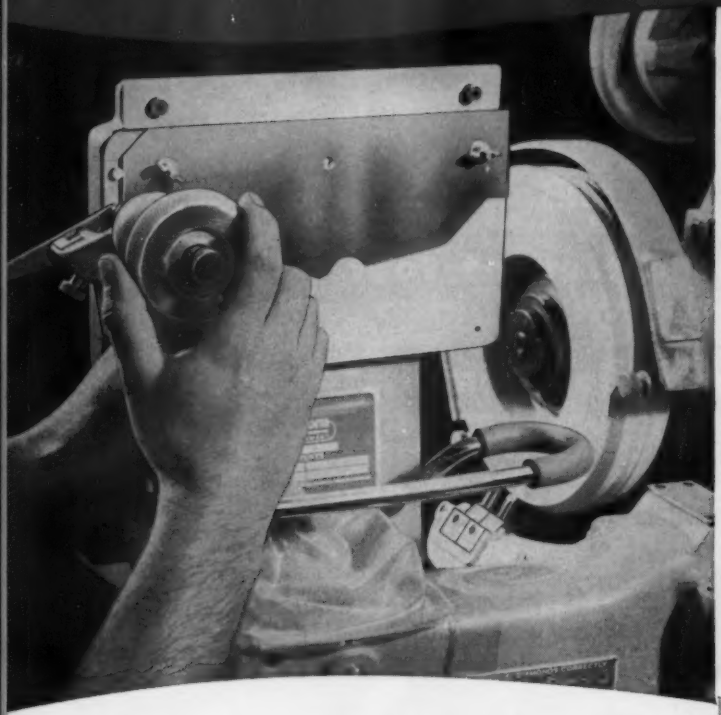

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In locked position, the fiat surface of holder wedge is tightly seated in mating notched section of tool shank. Normal operating torque tends to further tighten this wedging action, thus, preventing all possibility of tool play or wobble. Where unusually large tools or extra heavy cutting operations are required, provision is made on the holder for use of a Baker drive to augment wedge locking and assure utmost stability.

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5. Positive wedge type locking of tools.
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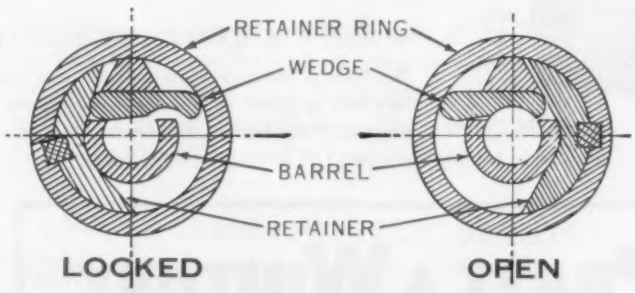
7. Simple insertion and removal of tools.
8. Can be used for right or left-hand cutting tools.
9. All tools quickly ground for use in holder.
10. Designed for standard straight shank end mills.



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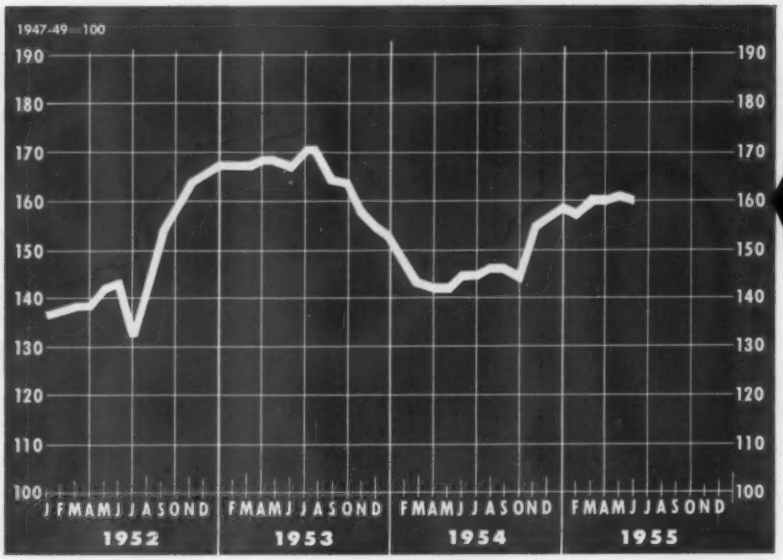
Gaging Metalworking . . .



Production Index

BASED ON MANHOURS WORKED IN THE FIVE COMPONENTS

	JUNE Estimated	MAY Preliminary	APR Revised	MAY Year Ago
Total index	**160**	**162**	**160**	**147**
Machinery	132	130	124	
Electrical Machinery	186	185	163	
Autos	163	156	106	
Other Transportation	262	272	296	
Other Metalworking	135	132	124	

AMERICAN MACHINIST INDEX OF METALWORKING PRODUCTION

Metalworking makes amazing record . . .

Metalworking has come up to midyear with an amazing performance that far surpasses what anyone had anticipated. It entered 1955 at a dizzy height and has managed to go even a bit higher since then.

The last half should be a memorable six months too. It is doubtful, however, whether it will match the January-June period during which the automobile industry set a pace that it cannot maintain from here on, if for no other reason than the inevitable break in production that comes with new-model changes.

At midyear, things in Metalworking look about like this:

Steel output for the year should be about 110 million tons, an increase of 25% over 1954. Production will be less the second than the first half, but demand from machinery builders will partially offset the drop in shipments to the automobile people.

New passenger car record . . .

Automobile makers set a new record in passenger car assemblies (4.3 million) in the first half. Prediction for the year: 6.9 million cars and 1.3 million trucks. That almost matches the 1953 all-time total.

From here on, motor car output is expected to droop a bit because of high stocks in dealers' hands (900,000 cars) and a slackening in consumer demand.

Shipments of automobile and truck parts are up 35% over last year and are 15% higher than in the previous peak year of 1950. Sales of replacement truck parts have been particularly heavy.

Electric appliance manufacture has been one-fifth better than last year, with dryers and ranges leading in sales gains. Sales and output should continue very brisk the remainder of the year, despite possible price advances.

Radio and TV sets doing well . . .

Nearly 7 million radios and 3.7 million TV sets were produced the first six months, compared with 5 million radios and 2.8 million TV sets for the January-June period in 1954. TV production, however, is being cut more than seasonally because of inventory build-up.

Aircraft production has leveled off this year. Government outlay for new planes probably will go up the second half, as will shipments of civilian planes.

Farm machinery has turned upward. Farm tractor shipments have been comfortably better this year. Though farm income will be down, equipment sales are likely to be 10% up.

Electrical machinery builders report an uptrend in business, as against a downtrend a year ago. Output this year should be 5% better than in 1954. Most of the gain will be in the second half.

Construction machinery in big demand . . .

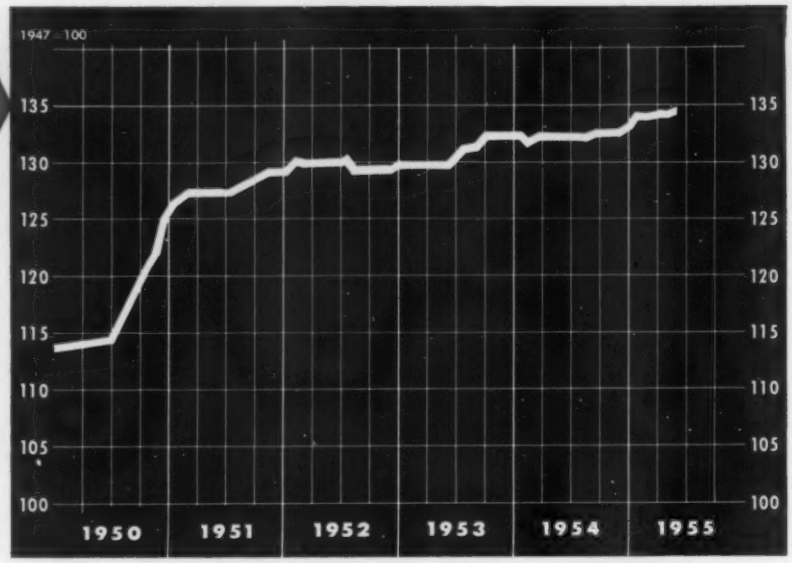
Construction machinery makers are having a good year. All types of excavating and road building machinery are doing well. Shipments are about 10% ahead of the 1954 volume. And the second-half outlook is bright.

Railroad equipment production is lagging far behind last year. But this year new orders have outrun shipments. This suggests a higher output the second half. That applies to freight cars, passenger cars and diesel locomotives.

Gaging Business . . .

Price Index

	JUNE Estimated	MAY Preliminary	APR Revised	MAY Year Ago
Total Index	**134.8**	**134.6**	**134.5**	**132.4**
Metalworking Machinery	**148.6**	**146.4**		**141.6**
Other Machinery exc. Electrical	**139.3**	**139.2**		**137.5**
Electrical Machinery	**131.7**	**131.6**		**130.1**
Fabricated Metal Products	**130.8**	**130.8**		**128.7**



AMERICAN MACHINIST INDEX OF METALWORKING PRICES

Production good outside Metalworking . . .

Business is going along at a hot pace throughout both hard and soft goods industries.

Here is a quick rundown of the situation in fields outside Metalworking:

Chemical industry has been out 6% more products than in the second half of last year and 10% more than in the first half. The upward trend should continue the remainder of this year.

Plastics and synthetic fibers are recording sensational gains over 1954.

Output of lumber and lumber products is 12% better this year. Number of board feet cut is up only a little. But millwork and plywood manufacture are riding the building boom.

Gains expected in lumber . . .

Production of lumber products will show even more impressive gains the second half, because the industry went through a major strike last summer.

Textile industry has been operating at the highest rate since early 1953. In first six months, output was 12% up from last year.

Synthetic fabrics have made a sensational showing. Wool textiles too have done well. Cotton consumption and knit goods have increased 5% over 1954.

Textile production will be off some the latter part of this year. Number of inactive spindles is growing and textile prices no longer are rising.

Output of food products inched up 1% this year. Reason: a healthy increase in processed meat production. Beverage volume has been about the same as a year ago. Chances are good for an all-time high this year in food and beverage production.

Outlook bright in furniture . . .

Outlook for furniture industry is fine. Housing completions will be very high. Moreover, a large number of new office buildings are being completed. Household furniture is up 11% from a year ago.

Rubber products manufacturers have increased output 20%, thanks to a thumping demand from the automobile industry. Replacement tire market is getting a good lift from development of tubeless tires. But a drop in tire shipments is certain as car assemblies taper in the second half.

WEEKLY BUSINESS INDICATORS

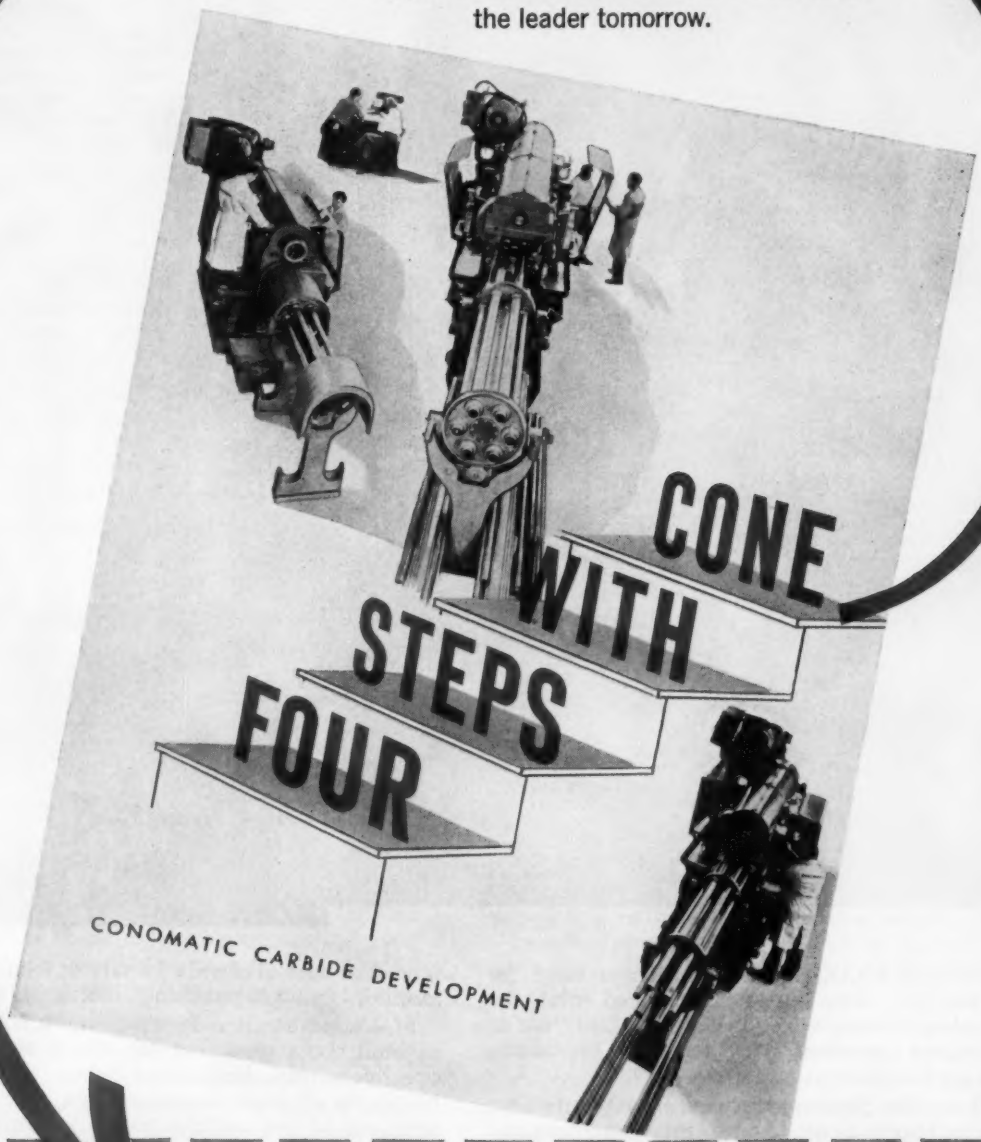
	Latest Week	Preceding Week	Year Ago
Business Week Index of Activity (1947-1949 = 100)*	143.1	142.2	126.8
Steel ingot operation (thousands of tons)	2,350	2,316	1,720
Electric power output (million Kilowatt hours)	9,987	10,041	8,850
Production of automobiles and trucks	183,987	172,794	163,731
Engineering construction awards (*Eng. News-Record*—millions)	$412.1	$328.0	$313.0

MONTHLY BUSINESS INDICATORS

	Latest Month	Preceding Month	Year Ago
Index of industrial production (1947-1949 = 100)*	138	136	125
Index of durable manufactures production (1947-1949 = 100)*	153	150	136
Durable goods manufacturers' sales, millions*	12,819	12,860	11,160
Machinery manufacturers' sales, millions*	3,205	3,318	3,198
Durable goods manufacturers' new orders, millions	12,684	13,353	12,142
Machinery manufacturers' new orders, millions	3,175	3,404	2,936

*Seasonally adjusted

If you haven't read this important booklet, your production line may be operating at less than peak efficiency. Your operations may be beating competition with HSS today, but you will likely need carbide tooling to be the leader tomorrow.



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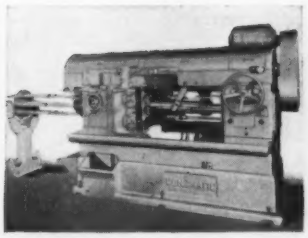
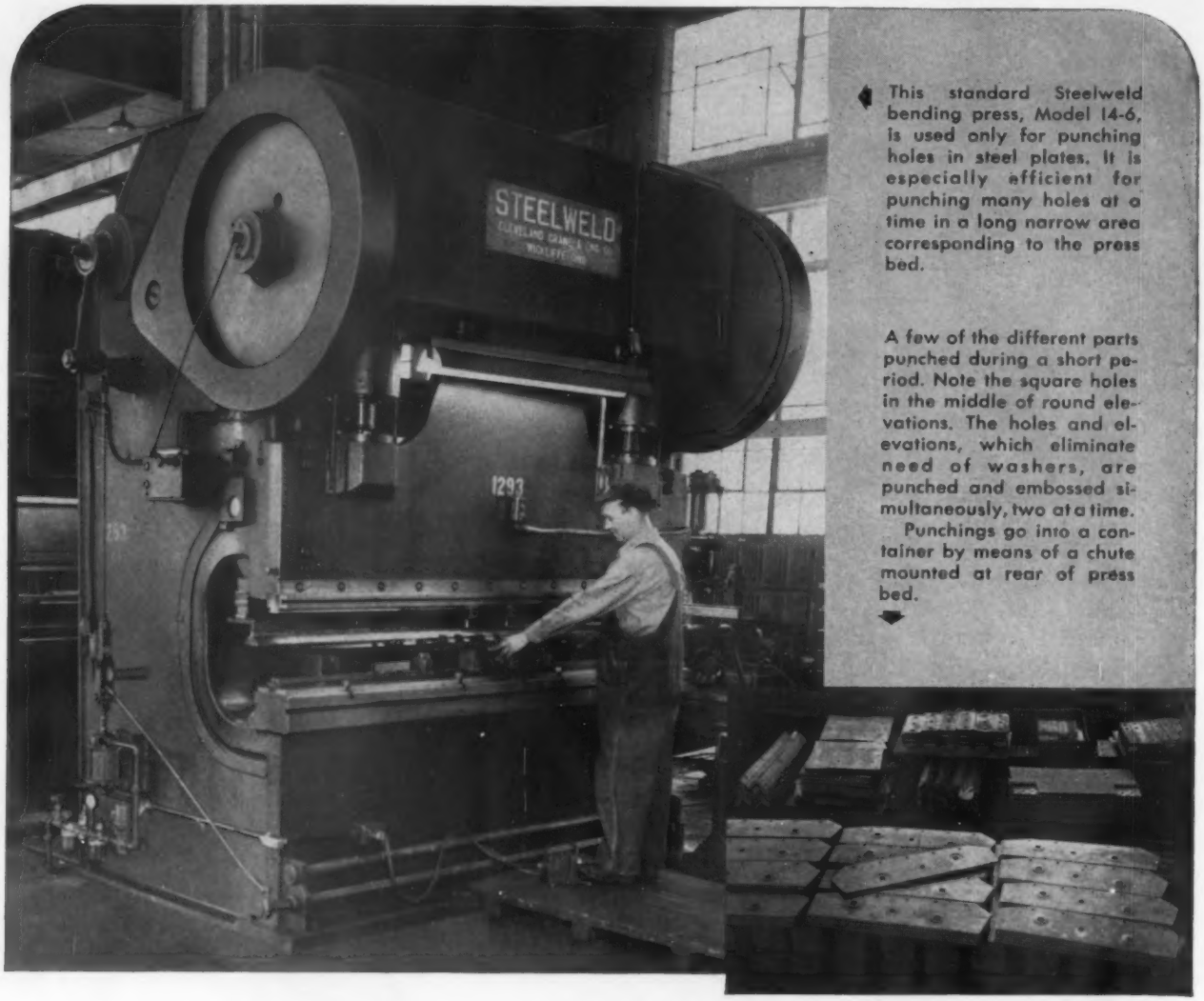


Conomatic

THE MACHINE TOOL SHOW CHICAGO, ILL. BOOTH 401

CONE AUTOMATIC MACHINE COMPANY, INC., WINDSOR, VT., U. S. A.

Press Brake Used Solely For Multiple Punching



This standard Steelweld bending press, Model 14-6, is used only for punching holes in steel plates. It is especially efficient for punching many holes at a time in a long narrow area corresponding to the press bed.

A few of the different parts punched during a short period. Note the square holes in the middle of round elevations. The holes and elevations, which eliminate need of washers, are punched and embossed simultaneously, two at a time.

Punchings go into a container by means of a chute mounted at rear of press bed.

BENDING BRAKES are not always used for bending. Here is one that is used solely for multiple-punching work. It is on its 12th year of continuous operation, punching holes of various sizes and numbers.

While other Steelweld presses in the plant where this machine is located handle many bending and forming operations, any Steelweld can be quickly switched from one form of work to another and thus take care of a wide variety of jobs: bending, forming, multiple-punching, blanking, etc.

Steelweld Bending Presses are versatile, heavily-built tools designed for quick set-up, easy operation and long trouble-free performance. Hundreds of these machines are serving every segment of the metal-working industry. If you need a press brake, you will be happy with a tried and proven Steelweld.

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American Machinist

MAGAZINE OF METALWORKING PRODUCTION * ESTABLISHED 1877

Why All the Fuss About Automation?

Automation should get the prize as the 1955 Word of the Year.

It is the subject of scholarly discourses by engineers, scientists, industrialists and editors. It is on almost every program of every technical society. It is in the headlines of newspapers and magazines. It is the main excuse for Walter Reuther's dramatic attempt to secure a guaranteed annual wage.

As yet, it is not in any dictionary. But it soon will be. It is serving a tremendously useful purpose because it has caught the imagination as a symbol of what is happening in industry.

For the fact is that the process of substituting mechanical power for human power has been remarkably speeded up just in the past year in the nation's metalworking plants, and in other industries too.

No longer is a Ford engine factory at Cleveland an isolated example of automaticity. Automatically controlled manufacture of metal products, from the receipt of materials to final inspection, is not yet commonplace, but it is not regarded any more as a phenomenon.

Entirely mechanized departments, if not complete plants, are not unusual today. And notable progress is being made in combining multiple operations, formerly performed by a battery of machines, into one machine that does the whole job without human intervention.

Never before have there been so many important developments in such a short time in mechanizing the processes of cutting and forming metal and in automating the assembly and inspection of metal products.

Never before have manufacturers adopted the new techniques as rapidly as they have lately. Management is more open-minded toward investing the necessary capital to put the new techniques into practice.

This rush to develop and adopt new mechanical processes of manufacture is not a passing fad, such as the Mamba may be in dancing at the moment. There are good solid reasons why the rush will not subside and may even be intensified.

The truth is that industry is hard up against the fact that people no longer want to do strenuous physical labor. At the same time they want to be paid top rates and get all the side benefits that go with employment these days. The only way that a manufacturer can afford to keep them on the payroll is to make sure that they constantly produce more not by muscle power but by the aid of horsepower.

Then there is the profit angle. Thin profit margins are a rough problem in many companies (and this problem is likely to become more acute rather than less as time goes on). "Cost cutting is getting to be THE big job," as one observer states.

Yes, there is a good explanation for all this fuss about automation. Less and less emphasis is being put on defense production, which now represents a relatively small percentage of the nation's metalworking output. More and more responsibility is thus being thrown upon the civilian economy to sustain our national prosperity.

That inevitably means that competition, as one economic service puts it, "will be grinding a sharper and sharper edge every day." Prices are under fire and, in turn, so are costs.

Don't make the fatal error of brushing off automation as a 1955 fancy. It has been with us a long time, though it is just now getting top publicity. It is here to stay.

Every metalworking shop that wants to turn out work better and cheaper has a stake in automation. You can see automation in action at the Machine Tool Show in Chicago in September.

Burnham Finney

72 HOLES

*Photos courtesy Kirk & Blum, Cincinnati, Ohio

SEE CINCINNATI SHAPERS, SHEARS, PRESS BRAKES BOOTH 1105

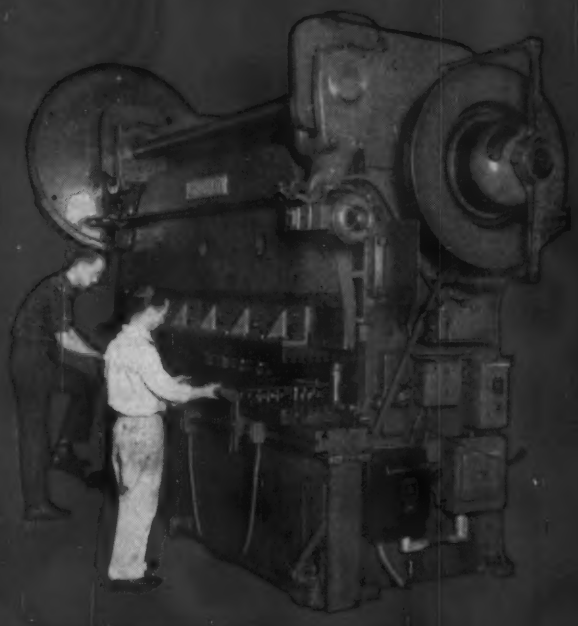
where they belong

Economical assembly depended on maintaining the accurate spacing of these 72 holes and their accurate positioning on this 10-gauge sheet.

This Cincinnati Press Brake is giving a high production at low cost by its speed and accuracy of performance, which insures rapid low cost assembly.

As a press, they offer high production with low investment. As a Press Brake, their low set-up costs, quick change-overs and versatility bring profits.

Write for Catalog B-4 where many examples of the versatility of Cincinnati Press Brakes are illustrated.



CINCINNATI

THE CINCINNATI SHAPER CO.

CINCINNATI 25, OHIO, U.S.A. SHAPERS • SHEARS • BRAKES

American Machinist

How to diagnose and cure hidden tap ailments

Tap manufacturers go to considerable effort to assure quality products. Still, a variety of hidden errors can slip through the net. It is only sound economy and good practice to inspect every tap before you use it, especially when precision threads are specified. Here is what to look for . . .

HOWARD URBAN, LEONIA, NJ

Pitch diameter, thread form, lead error, root, body, and shank diameters of standard taps are carefully controlled within the small tolerances allowed by federal and manufacturing association specifications. Nominal values and allowable variations for these items are listed in all tap catalogues and standard references. Other items equally important to successful tapping, however, are not so specifically detailed or controlled, nor is information on the importance of and limits for such items as chamfer runout, land-width variations, web centralization and tap concentricity generally available. Hence, industrial personnel concerned with tap inspection, design, manufacturing or tool trouble are handicapped in their understanding and use of one of the most complex cutting tools.

Setting allowable limits for the examples mentioned above, and similar physical characteristics of the tap, is properly a function of the engineering standards associations. However, to gain a better understanding of the tap, as a tool and as a difficult item to manufacture, one should study the tap manufacturing process, the functional aspects of the various tap components, inspection procedures, and approximate limits for these items.

Problem number one in tap manufacturing is to maintain the concentricity of the various components. Concentricity errors occur from heat-treat distortion, bending, centers, and center-angle errors; also speeds and feeds, the condition of the tools used, and the usual production variations. Here are the cause, effect, and limits for various concentricity relationships:

1. Concentricity of the shank to the tap threads. Most of the tap-manufacturing operations are done between centers. It is therefore possible to have a runout condition between the shank and the centers on which the tap is processed without any effect on the concentricity of the other components. Actual tap use, on the other hand, is invariably by collets or similar devices, locating and clamping on the shank. Thus, the runout of the shank with respect to the threads, flutes, and chamfer is directly translated to the tapped hole, resulting in oversize holes, excessive wear on the "high" tap land, increased tapping torque requirements, and possible loading of the tap teeth.

The concentricity of the shank to the threads can be easily checked with a V-block or bench centers and a dial indicator with a ball or taper point small enough to ride on the flanks of the tap threads. If the shank is mounted on a V-block and the indicator aligned with the helix angle of the threads, readings taken on the threads will be the true runout. When using bench centers, however, it is necessary to *locate the direction of the runouts* on the shank and thread to determine *if they add or cancel.*

Taps are guaranteed as to pitch diameter only, and the different pd ranges (cut thread, commercial ground, precision ground) are recommended for different classes of fit to allow for tap, chamfer, and tapping machine runouts as well as other uncontrolled variables. Because a tap with an indicated runout of 0.001 in. fir will tap a hole about 0.001 in. over the measured pd, class of fit must be considered in any determination of allowable runout limits. In my opinion runouts of less than 0.002 in., where allowed by the tap size-range and the required fit for the tapped hole, will not unduly affect tap life or the finish of the tapped hole. Runouts greater than 0.003 in. fir, especially for taps under a three-quarter-inch nominal diameter, will unevenly load the tap and the spindle of the tapping machine, in addition to tapping beyond the acceptable limit.

2. Concentricity of the shank to the chamfer.

This item will not affect the size of the tapped hole as directly as shank to thread runout but the effect of chamfer runout on the life of the tap is extremely important. As the chamfer does most of the actual removal of material, any over-

loading of one land resulting from runout will quickly result in excessive wear and possible loading or chipping of the tap and consequent damage to the tapped hole. The required torque for tapping rises significantly when the tap has a chamfer runout condition.

Controlling chamfer runout is the most complex production problem facing the tap industry. Fig. 1 shows how land-width variations combine with the eccentric action of the chamfer relief to produce this runout. Land-width variations, unfortunately, arise in so many ways that it is difficult to maintain the tight control, throughout the entire tap making process, necessary to hold them within acceptable limits. Indexing and flute-milling errors, bending, center distortion (particularly in the soft state), body runout, web variations, or flute polishing errors all result in chamfer runout.

Although it is a simple matter to measure the land widths of a tap with a micrometer, it is difficult to correlate this information with actual chamfer runout. For this reason, and because chamfer runouts can be introduced by the chamfer grinding, it is suggested that the chamfer cutting edge be checked with an indicator and V-block or bench centers. The indicator should be set square to the chamfer angle and the same precautions observed whether using bench centers or V-block readings. Approximate limits for chamfer runout are as follows:

0.001 in. fir for taps up to ¼-in. nominal dia

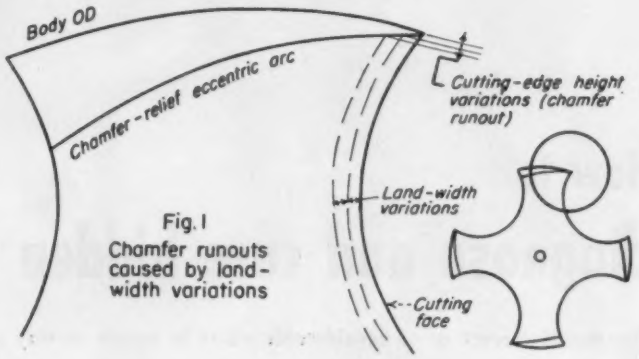


Fig. 1
Chamfer runouts caused by land-width variations

0.002 in. fir for taps from ¼-in. to ¾-in. nominal dia

0.003 in. fir for taps from ¾-in. to 1¼-in. nominal dia

3. Concentricity of the flute to the body.

Any variation in the flute form, depth, or concentricity will result in different cutting-edge angles on the affected tap land, Fig. 2. As in any other cutting tool, changes in the cutting-edge angle will affect the life of the tool, the finish on the work, the power requirements, and in certain materials, the ability to tap successfully.

Because of the configuration of the flute form, changes from positive to negative cutting-edge angles can arise from comparatively minor flute variations. These variations occur in exactly the same manner as the land-width variations but their effect on the cutting-edge angle is not as easy to inspect as chamfer runout. For this purpose, optical tap analyzers or special inspection setups, rarely warranted outside the tap industry, are required.

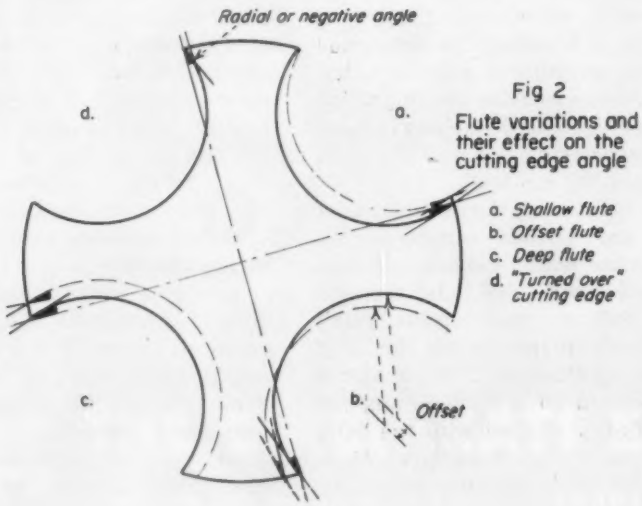


Fig 2
Flute variations and their effect on the cutting edge angle

a. *Shallow flute*
b. *Offset flute*
c. *Deep flute*
d. *"Turned over" cutting edge*

For general use, a check of the concentricity of the flute to the body and a visual examination of the cutting-edge angle is adequate. Assuming that the body outside diameter is close enough to a perfect circle not to introduce any significant error, it is simple to set up a dial indicator and take comparative readings of the flute concentricity, as shown in Fig. 3. It is necessary to take these readings *within the same area* on all of the flutes as most taps have a deliberate back taper in the flutes to decrease the bending and torsional stresses at the middle.

Comparative readings within 0.010 in. to 0.015 in. should be acceptable. Total variations above this amount or a large variation on any one flute call for a closer examination of the cutting-edge angle. Experienced shop or inspection personnel will have little difficulty in picking out a significant change in the cutting-edge angle on any of the flutes. Most cases of excessive variations of the flute depth or form will be rejected on the basis of the resultant land-width variation and chamfer runout.

4. Concentricity of spiral points to the body.

The spiral point or "gun" is a second fluting to provide a special form for the chamfer cutting-edge, used to "shoot" the chips ahead of the tap. As such, it is subject to the same ailments as the flute. Again, this problem is the more serious because of the greater amount of material removed by the chamfer. These variations, however, can be pinpointed by indicating the chamfer cutting-edge and visually examining the trace of the spiral-point grind and the chamfer

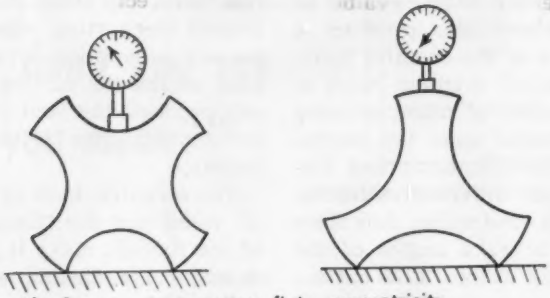


Fig 3 How to measure flute concentricity

cutting-edge angle. As these problems arise in different ways with different effects, it is necessary to utilize all three methods. For example, variations of the trace, Fig. 4, can be caused by indexing errors or grinding-wheel breakdown. Indexing errors will cause cutting-edge variations while grinding wheel breakdown may or may not cause them, depending upon whether the wheel has broken down on the trace or the cutting-edge side.

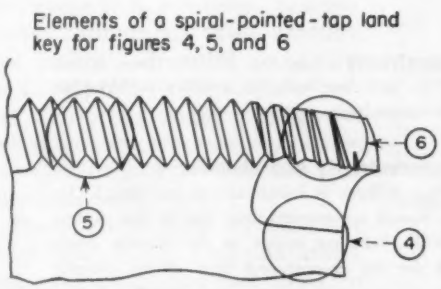
Errors introduced in several other ways have the same variable effect. The limits discussed in reference to the chamfer runout, item 2, are completely applicable to the chamfer of the spiral-pointed tap and the inspection method is identical. Trace variations are not important in themselves unless the cross-sectional area of the tap has been reduced significantly. Comparison with similar taps can be used as a basis for setting limits on the web measurements of spiral-pointed taps as this item is definitely a function of the manufacturer's design.

Acceptance of a tap on the basis of cutting-edge angle discrepancies must be left to the responsible supervision. Because spiral-pointed taps are especially ordered to obtain the particular advantages of this form, examination of the cutting edge is particularly important. It is easy to see a cutting edge which has been "turned over" or has a negative cutting angle, but a close examination is required to detect variations in the concave area below the cutting edge. And yet, these variations affect the function of the spiral point directly. Again, excessive variations of this type can and should be detected visually with a reasonable amount of effort and experience.

Another facet of the concentricity problem is concentricity of the thread form and the chamfer to each other's diameter as well as to other tap components. The theoretical ground thread is a perfect circle regardless of the number, size, form, or location of the lands. All of the chamfer cutting edges should intersect the eccentric arc of the relief form at the same point. The cause and effect of variations from these ideal conditions are:

1. Thread grinding

At the entrance of the grinding wheel into the tap land, there is a tendency to "pull." The tap will bend somewhat under grinding pressure, dull wheels, too high a speed or feed, poor coolant action. These and other grinding idiosyncrasies can cause distortion from the true circle. The result is a high or low cutting edge depending upon whether the thread form at the cutting face is equal to or higher than the rest of the tap land or conversely, lower than any other point of the tap land. Taps with a high cutting edge probably will do an excellent job as the effect is similar to the relief on any other cutting tool. Low cutting edges on the other hand, produce a rubbing action because the tooth form actually cut is smaller than other parts of the tap land. Excessive heat generation (that draws the hardness of the tap), excessive power requirements, possible binding and/or breakage—all result



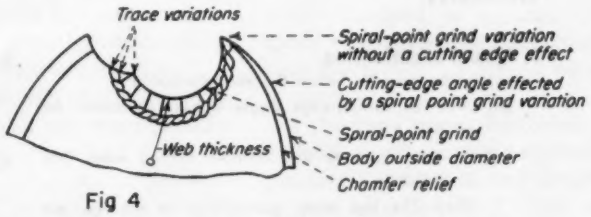

Trace variations
Spiral-point grind variation without a cutting edge effect
Cutting-edge angle effected by a spiral point grind variation
Spiral-point grind
Body outside diameter
Chamfer relief
Web thickness

Fig 4
Partial front view of a two-flute spiral-pointed tap

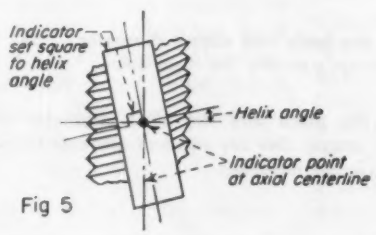


Fig 5

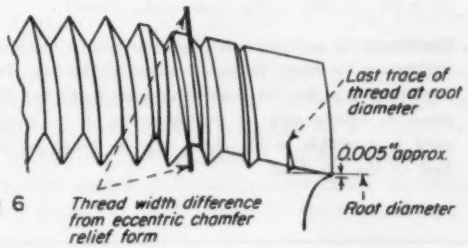

Last trace of thread at root diameter
0.005" approx.
Root diameter
Thread width difference from eccentric chamfer relief form

Fig 6

from the rubbing action of a low cutting edge depending on the magnitude of the cutting-edge drop.

Using a ball or taper point indicator and a set of bench centers or a V-block, the comparative height of the cutting edge can be checked by indicating the entire land width. To provide reasonably accurate readings, the indicator must be carefully aligned with the helix angle of the thread and the axial centerline of the tap. This is necessary to insure that the indicator point is not riding up the sides of the thread as a result of the helix angle. It is possible to accept drops of about 0.001 in. on any one land because so little material is removed by the full thread form.

2. Chamfer Grinding

Low cutting edges on the chamfer cause equally poor results. In addition to the difficulties encountered in thread grinding, it is necessary to align the cutting edge with the eccentric throw of the relief grind. By setting the indicator square to the chamfer angle and indicating the entire land, it is a simple matter to determine if the cutting edge is the high point of the chamfer. It is not suggested that *any* condition of low cutting edges be accepted on the chamfer.

Indicating the chamfer land as described above also provides a good picture of the chamfer form. The amount of chamfer relief is purely a matter of manufacturing standards based upon the manufacturer's investigations and experience with different materials, tap hardness, land width, flute form and hook, or rake angles of the particular tap design. Low cutting edges, discontinuities in the relief form or "heel up" chamfers, however, are not deliberately provided by any manufacturer. Very sharp or very shallow reliefs are not provided without a specific customer request.

The cutting edge must have sufficient body behind it to resist the high stresses introduced by the cutting action and yet it must have relief to provide a true cutting edge. Again, the amount of relief is and must be a matter of the individual tap design but, to provide some basis for a reasonable evaluation of the indicator readings taken, it is suggested that the total relief should be in the neighborhood of 1/10 the land width. The increment of indicator rise should be fairly steady across the entire tap land but the area just behind the cutting edge is the most important. Any extreme variation from this value, any sharp drop directly behind the cutting edge, or, conversely, no applicable relief in the area behind the cutting edge, and any point on the land higher than the cutting edge would call for rejection.

The eccentric form of the chamfer relief and the triangular form of the threads make it possible to examine the chamfer relief visually. If the top of a pyramid is removed at an angle to the base, the remaining parts will be wider at the lower portion than at the upper. The tap teeth following the chamfer are similar to this pyramid because more material is removed at the back than at the front and the thread form is triangular. Fig. 6 indicates the various traces used to interpret the amount and form of the chamfer relief. Little relief will show as a gradual widening of the tooth top and excessive relief will result in a rapid widening of the tooth form. If the trace of the root intersection remains at the front of the tap, it indicates that the chamfer is not below the root diameter as required for proper tap entrance into the hole. Once the effort is made to inspect these details, the experience necessary to reliably evaluate this visual examination will quickly follow.

CHECKLIST

1. Visual examination
- (a) Is the chamfer below the root diameter?
- (b) Does the cutting-edge angle appear consistent on all flutes?
- (c) Are the tap teeth and chamfer cutting edge free of defects?
  Note: The tap teeth, particularly at the tip, are hard and tend to be brittle. Any mis-handling will chip the teeth or the chamfer cutting edge.
- (d) Is there any indication of grinding burns on the teeth or chamfer?
- (e) Is the chamfer cutting edge angle correct?

2. Hardness—If equipment is available, take a hardness reading on the front, shank, or square of the tap. The hardness range for the body should be R_C 62-65. The shank or square may be slightly softer. If no equipment is available, a file check may be taken on the heel of the tap land.

3. Web concentricity—(See Fig. 3). This item is not significant as such but indicates possible cutting-edge or chamfer-concentricity errors.

4. Thread concentricity and chamfer
Set tap on a V-block or bench centers per Fig. 5. Indicate for thread concentricity and high or low cutting edge. Set the indicator square to the chamfer angle and check for the amount and form of the chamfer relief, high or low cutting edge, and chamfer concentricities.

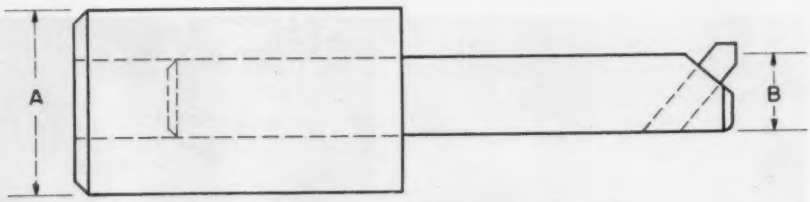
5. Check the body and shank diameter. (See the manufacturer's catalog for these limits.)

6. Check the pitch and the pitch diameter using wires or gages. (See any standard reference for over-wire conversion formulas.)

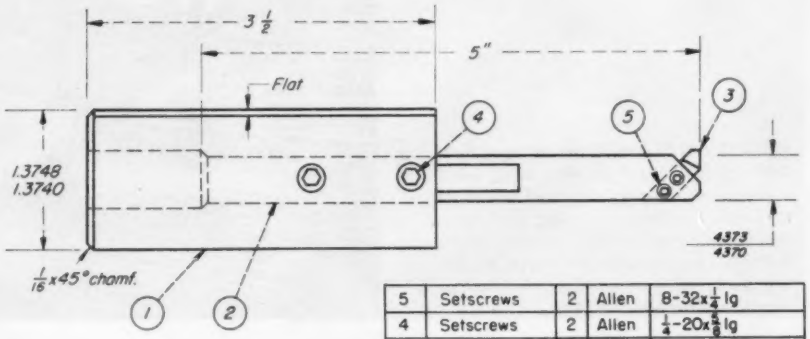
"Why don't you say what you mean?"

He's a clever production man who can order exactly what he wants by telling the supplier exactly what it is

HAROLD D RHODENBAUGH

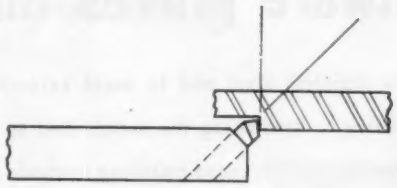


APPROVED SKETCH, or basic design. It went out with order for boring bars



Det	Name	Amt	Mat	Notes–R stock
5	Setscrews	2	Allen	8-32x1/4 lg
4	Setscrews	2	Allen	1/4-20x5/8 lg
3	Boring tool	1	78B	1/4-dia carb. tool
2	Boring bar	1		Mach. stl, hdn
1	Adaptor	1		Mach. stl, hdn

BORING BAR ASSEMBLY



VENDOR'S DRAWING. The bars checked with this, so they were accepted

HERE'S WHAT HAPPENED — the bar wouldn't cut a square corner, which was required, but wasn't mentioned anywhere

Take a boring bar; a fairly simple one, intended to bore a hole in part No. 20000003, Operation No. 51. Tool Design is overloaded, and the toolroom hasn't time to fiddle with such trash. Have to purchase the bar outside. Make it three, in case of trouble.

You get authorization, and hand the order to your purchasing department for quotations. There's a part print, a sketch of the boring bar required, and a dandy little note, "to manufacturer's best standards", which means precisely nothing. A small job shop in the next town gets the order on price, and delivers three bars after a week or so. Now they go into the tool crib to wait until Production can use them.

Days, weeks, or months later, a machinist draws a bar and sets up the job. *He* goes to work, but the bar doesn't. It advances, quivers, shakes, jumps, gouges, chatters, and makes a dreadful noise. The operator pulls it out, adjusts here and there, and finally manages to ram it into the workpiece. Luckily, he takes the part to Inspection, and gets laughed at.

The operator yells for help, the setup man jumps into the arena, and eventually the tool designer gets called down. They have a huddle. They consider the production rate, examine the boring bar, and roll their eyes. The superintendent walks by and asks them what they're doing. They make a rush and start getting busy.

RESULTS?

1. Waste of initial order request.
2. Loss of time in waiting for quotations.
3. Cost of correcting Vendor's errors.
4. Loss of time before tooling has been released to Production.
5. Loss of prestige because of failure to meet delivery date.
6. Loss through overtime, etc, because of failure to meet production schedules.

WHAT TO DO?

Make sure, when tools are to be purchased to a vendor's design, that *all* necessary information is specified on the order, including sizes, shapes, and quality standards. In the case of the three little boring bars, the customer had no recourse because he got what he asked for—a boring bar. It just happened that the vendor's best standards' were a little bit flexible. He didn't get what he wanted; but he never said what he really wanted, so he can't blame the vendor.

Make sure a little extra time and trouble is spent on this kind of an order. It will always be worthwhile. Instead of saying, "Make three tools like this here to make that there part", it would be wiser to specify:

3 boring bars, hardened and ground on all working surfaces, to produce diameter X and dimension Y per attached B/P. Bar to be mounted in 1.375-in. spindle of No. 7 Zilchmatic boring machine. 15 carbide boring tips (solid, grade VVZ) to be provided, designed per projected-angle drawing attached, and fitting interchangeably in all three boring bars. Tolerance on X is ½°, tolerance on Y is ± 0.003 in. Tracings or a complete set of detailed prints showing pre-set dimensions must accompany boring bars to insure prompt acceptance.

SPOONS ARE BLANKED two at once from 0.080-in. high-nickel stainless strip, using a Federal 65-ton press. To avoid scratching the strip, it is received boxed and interleaved with paper, and the free end is supported on a wooden crosspiece. All dies are made of air-hardening die steel to minimize distortion

Stainless flatware proves that beauty results

To produce an extremely high finish on stainless steel and to avoid excessive polishing costs, all processing steps must avoid pitting or scratching the metal. And to be competitive and meet market demand, mechanization and advanced polishing methods are essential

Stainless steel is a metal that can be polished by high-production machines to a beauty all of its own —a white color with a bluish cast in hollow surfaces, as in spoon bowls. As compared to utilitarian uses of the metal, stainless that has been polished just short of a reflector finish provides a new medium for products associated with good living in the modern tempo.

We have a case in point for you: Stainless-steel flatware, as made by the Imperial Knife Co, Providence, R I, is designed and made to grace American dining tables. It has the appearance, the balance, the finely finished detail which the housewife of discernment demands.

The esthetic values of Imperial flatware are not accidental. Careful attention to design, to tooling, to every manufacturing step, plus close inspection, are provided by a management that has for generations prided itself upon good workmanship. But that is not enough in a highly competitive market. Inherited skills have been supplemented by using the latest types of equipment, plus constant experimentation with improved methods of cold forming and finishing of metal.

When Imperial started in this business, it did not know anything about flatware manufacturing, and it didn't want to know how others made their products. Its management felt that its successful formula for making pocket knives and similar products could be applied to flatware: complete mechanization, ultra-clean conditions, and rigid quality control.

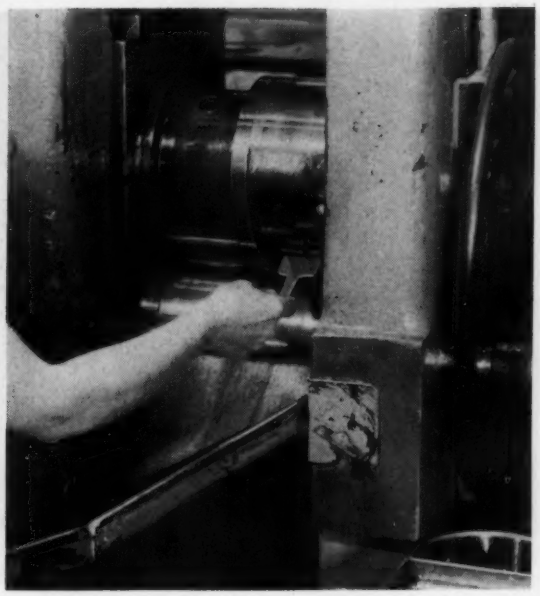
To be specific, they would bring to the problem their highly specialized knowledge of presswork, grinding, assembly and polishing. And to be even more specific, they would not hesitate to develop processes and to replace methods and machines whenever something better could be devised. Their attitude toward investment can be summarized by the statement: "It is better to put one's money into bricks, mortar and modern machinery than to let it pile up and be tempted into soft living."

This attitude may well bring into being a separate, conveyorized, perhaps automated, plant for stainless flatware in the not-too-distant future.

HOW TO FINISH STAINLESS FLATWARE

Selection of Material. To achieve the desired color and quality of finish, Imperial Knife uses expensive materials: high-nickel stainless for knife handles and other pieces, and approximately Type 440-B high-carbon stainless for blades. Criteria in selection of blade material are: (1) ability to take and

CLEANLINESS DURING ANNEALING is essential. Here cross-rolled spoon blanks are being laid upon nickel plates that shield the work from any dirt or carbon that has collected on the furnace conveyor belt



"GRADE ROLLING" tapers the spoon blank to thin it to proper proportions and "balance." Rolls have as many as three radii that must be smoothly blended. Annealing is generally required before grade rolling, because cross-rolling may increase the hardness by 25% or so

from mechanized polishing

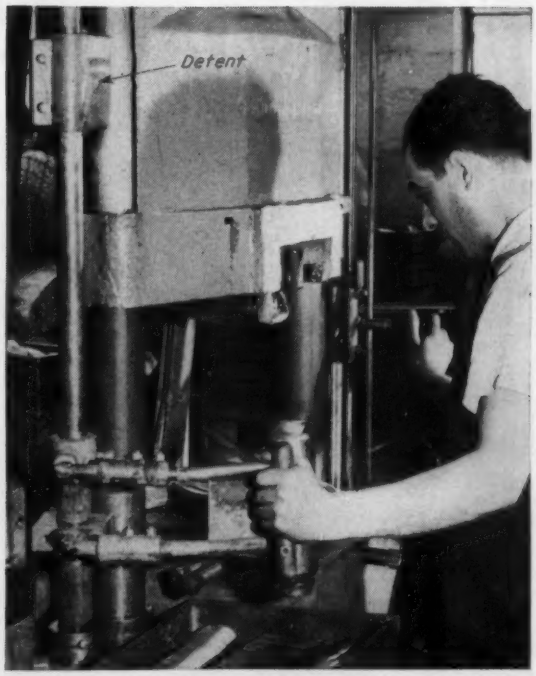
RUPERT LE GRAND, senior associate editor

hold a keen edge, and (2) appearance to match the balance of the flatware.

Segregation of Facilities. Except for heat-treating, the facilities for making flatware are segregated from those used for other products. Reasons are: (1) partly the psychological effect of "special facilities," because cleanliness and careful workmanship are essential to prevent scratching, (2) partly mechanical, as in the pressroom and toolroom, where equipment is larger and methods differ from pocket-knife manufacture, and (3) the need to set up "production-line" facilities for the product, as far as possible. The primary reason, though, for segregation of facilities is to avoid spoiled work or extra polishing costs from dirt or metal particles pounded into the surface or allowed to scratch the surface of work in process.

STEPS THAT MINIMIZE POLISHING

It's an expensive matter in any case to produce on stainless a finish that is just short of reflector quality. Surface defects introduced during processing are particularly hard to remove because of the hardness of the metal. And overpolishing affects the color. To avoid pits or scratches as from dirt or metal particles hammered into the stainless, and also to reduce pol-



TWO-HAND CONTROL assures safe operation of 400 lb pneumatic hammer, when striking work like spoon blanks which must be hand placed in the dies. Left-hand control consists of a detent and a copper-faced stop block that must be swung to left before tup can fall. Right-hand control admits air to cylinder

DIE AND PUNCH are finely finished, are stoned or polished at intervals. Dessert-spoon bowls are polished before striking. Utmost cleanliness up to and including this operation are essential, to avoid hammering dirt or metal particles into the spoon

BLANKS FOR HALF SHELLS of knife handles are formed and embossed on 1200-lb air hammers. Note stop block that swings automatically under the tup when the operator removes his hand from the handle

BELT GRINDER rounds edges of flatware handles, such as spoons and forks, produces a good finish that is easily polished later

ishing costs, in general, Imperial Knife follows these practices:

1. Cleanliness—Pressroom and the polishing department are swept three times daily. Each operator is paid extra to clean up his machine at the end of the shift. He is taught that his machine is the source of his living, and that he should take care of it.

An exceptionally large ventilating system carries off air-borne dirt from the polishing room.

2. Equipment Inspection—All dies are inspected after a predetermined number of pieces are made, not when trouble develops. Roving inspectors take samples to Quality Control, and have authority to shut down an operation until trouble is corrected. Operators are encouraged to inspect their work. In the case of pneumatic hammers, where the hand must be placed in the die to locate the blank, a two-hand safety device must be used before the tup can fall. This arrangement has the effect of slowing down the operation, so that the operator can inspect his work and tools constantly, as well as to work safely. Also, the hammer operators polish the dies at intervals.

3. Controlled-Atmosphere Heat Treating — Exceptional steps are taken to maintain cleanliness of the belt-type furnaces used to anneal or braze. During annealing of spoon blanks, for example, workpieces are laid upon nickel plates dropped onto the stainless-steel furnace conveyor belt. These nickel plates have the effect of keeping any dirt or carbon deposited on the belt from being picked up by the work. An ammonia atmosphere prevents work discoloration; work emerges as clean as it went in. Thus, oxides on the work are avoided. These could be forced into the metal during the cross or taper

rolling processes and be difficult to remove in polishing.

During the work week, annealing and brazing furnaces are kept up to heat 24 hr per day, to avoid contraction and expansion that would eventually create openings or holes in the muffle and allow atmosphere to leak in and spoil the work.

The original Sargent & Wilbur furnace has a long water-cooled after section for cooling the work in a protective atmosphere. A new C I Hayes furnace will have a long "degassing" tunnel, equipped with a flame curtain, ahead of the furnace.

Once a week the furnace muffle is cleaned, especially the roof. Vaporized metal from brazing operations are likely to collect on the roof. The point is: Remove the accumulation before particles drop onto the workpieces and get carried along to the cross-rolling and grade-rolling machines and are embedded in the blanks.

4. Prefinishing Before Forming—Workpieces are polished on certain areas, or ground to eliminate burrs and control width, before forming operations. Obviously, it is easier to polish or deburr while the part is flat.

Grinding of the sides, or edges, of spoons and fork handles is a fast operation that is performed on a "back grinder" with suitable cam control of the table and wheel, to follow edge contours. The operation establishes the correct width, removes the burrs, and proves an excellent prefinishing operation to reduce polishing.

Spoon bowls are polished in the flat before striking in drop hammers. A smoother finish and a better color are thereby secured at final polishing.

Edges of spoon and fork handles are rounded in a belt-grinding setup, with grit and other circumstances chosen to minimize the polishing subsequently required. Polishing wheels, instead of grinding wheels, are applied to "back grinders" for final polishing of these edges, the pieces being nested 60 or 70 to a fixture.

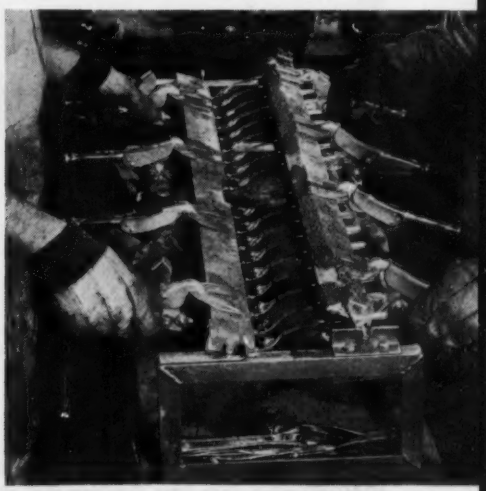
In other words, all of the preliminary and semi-polishing operations have been worked out so that they can be mechanized and the need for training of skilled polishers is eliminated.

The only hand operation is that of polishing the edges of spoon bowls on a belt. Here, the motions required are too complex for a mechanical setup at present.

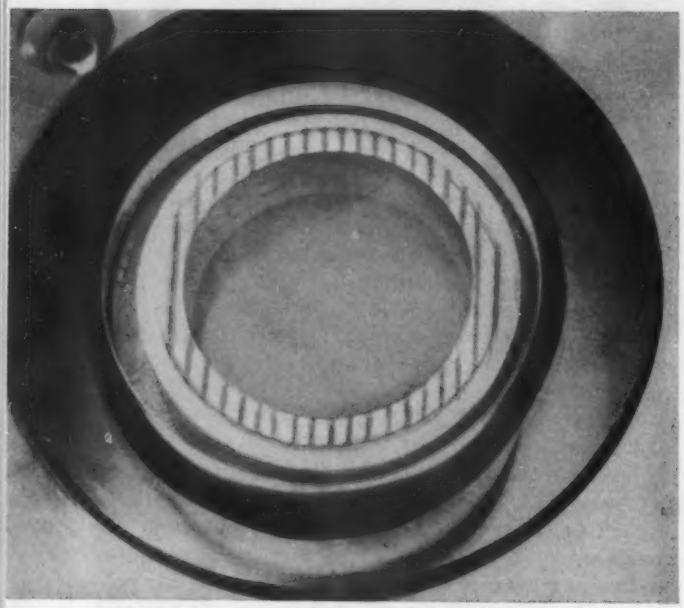
5. Mechanized Final Polishing—Final polishing, and buffing or coloring are done exclusively by machines operating under controlled time cycles and pressure. The operators merely load fixtures with say 50 pieces, place the fixtures in position on the machines and press a button. The machine automatically traverses the fixture into position for polishing the protruding ends of flatware. At the end of the preset time, the fixture is withdrawn to the unloading position. Three machines arranged in a hollow square, and served by two operators, give the same output as a roomful of operators working by hand and the results are uniform.

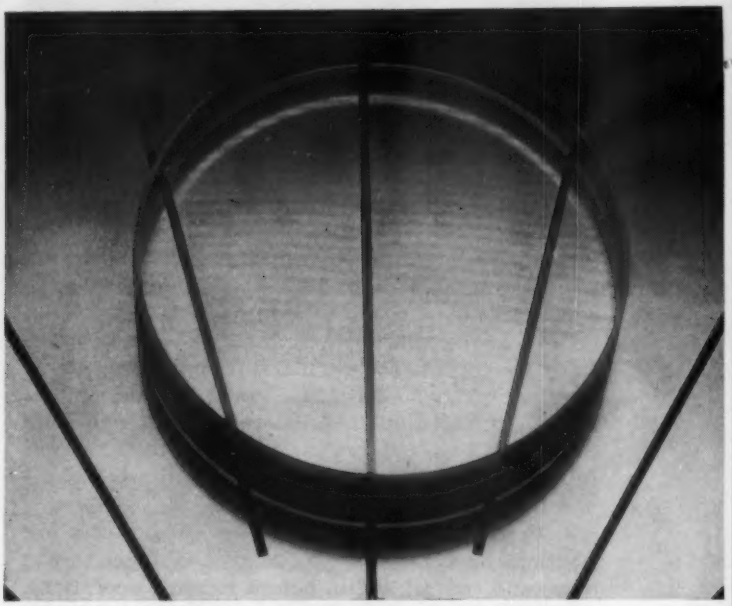
6. Press Room Handling—As in other shops handling stainless, the precut strip is interleaved with paper to avoid scratching during handling. Strips are lifted partially out of the wood crate in which received and fed into the dies. Stock has a good commercial finish but is not polished.

FINAL POLISHING is done on Clair Mfg automatic glazing and polishing machines. The three machines are set up to polish the back and front of the handle, the heel, and the back and front of the bowl



QUICK CLAMPING FIXTURES are made to hold flatware by the appropriate end. Left-hand fixture was used to polish spoons with handles protruding. Before releasing work from left-hand fixture, the right-hand one is slipped over the handles and clamped. Now the left-hand fixture can be unclamped so that the bowls can be polished. System saves racking time





1 . . ACCURACY IS CHECKED WITH OPTICAL FLATS on sealing ring (left) and lapping table (right). This ring will hold toxic or corrosive liquid, so flatness must be within one lightband (0.0000116 in.) and finish under 2 mu-in. rms. Regular standard for 4-in. rings and smaller is two lightbands and 5 mu-in.; or ¾ lightband per in. of dia on large rings. Table is flat within one lightband

Shop notes on lapping sealing

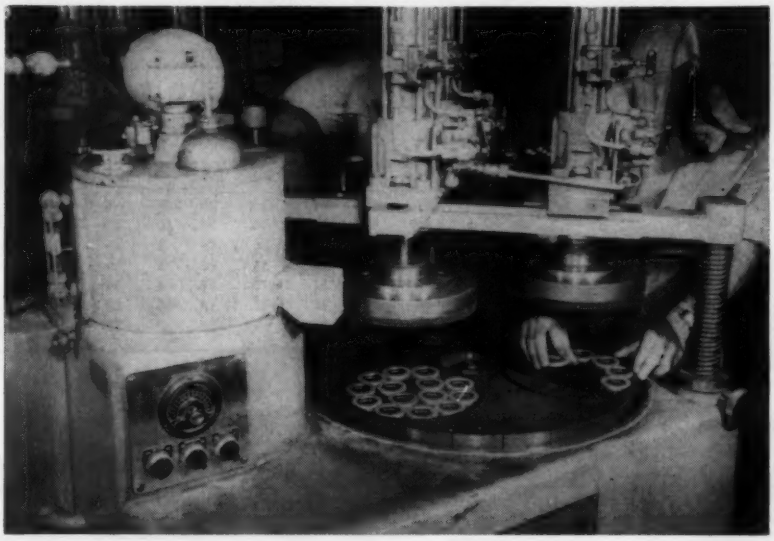
Five points to watch in precision lapping; five examples of how an experienced shop handles them . . . . . .

ERNEST F KATZKE, lapping technician, CRANE PACKING CO, CHICAGO, ILL

2 . . FIXTURES SPEED LOADING AND UNLOADING when parts have shoulders that allow preloading them while other fixtures are in lapping machine. Loads may also be fixturized if parts would damage each other by contact, or if hold-down pressure on predetermined points is required. Continuously fed abrasive is aluminum oxide in oil vehicle; except for cemented carbide or ceramic rings, where boron-carbide powder may be suspended in oil- or water-base vehicle

3 . . FELT PAD COMPENSATES FOR UNEVEN PARTS on first lap, or for warp. Felt is ¼ in. thick, and distributes hold-down weight to all rings. For thin, weak parts, or badly warped parts, pad may be ½ in. sheet of rubber. After lapping, rings are loaded, single-layer, in baskets and flushed with solvent, then dipped in vapor degreaser. Ceramic rings are dipped in caustic, then brushed

rings



4 . . POLISHING IS REQUIRED FOR APPEARANCE and to allow optical inspection, though matte finish meets specifications. Paper (4/0) is stretched taut on table, held by double-faced tape. Pressure plate has ½-in. soft rubber pad. Machine polishing takes 3-4 min; hand polishing is faster on small lots. Paper is cleaned by sponging with tissue moistened in alcohol

5 . . LEAD-ALLOY FACING ON LAPPING TABLE is charged with abrasive grains for finest polishing. Table rotates empty with conditioning rings, which spread abrasive into lead surface. Charge will last for 2-3 hr of polishing, then recharging is done dry—operator sprinkles abrasive powder, then rubs it in with optically flat hard steel block. Rubber pad holds down parts during polishing

How to achieve desired fits for involute splines

Development of the involute spline opened up new fields for stronger and longer-lived connections in power-transmission equipment and machine members. To achieve the desired fit of the external and internal members, consistent with their use, it is essential to apply certain allowances for inherent error in manufacture. The author explains the procedure in relation to the basic data found in the American Standard B5.15-1950

S J JOHNSON, chief engineer, SMALL-TOOL DIV
BARBER-COLMAN CO, ROCKFORD, ILLINOIS

Involute splines designed in accordance with American Standard B5.15-1950 have advantages over the older parallel-key splines in respect to tool economy and machining speed. For example:

1. One hob will generate all numbers of teeth of a given diametral pitch.

2. One hob and one broach will cut all types and classes of fits of the mating members—the external and internal splines.

3. The 30° pressure angle of the involute spline increases hob life, because the tool has more clearance behind the cutting edge. The freer cutting action also allows higher cutting speed.

Two types of fit, each in three classes, are used for involute-spline assemblies:

1. Major diameter fit. The bearing is on the major diameter, and the fit is controlled by varying the major diameter of the external spline.

2. Side fit. The bearing is on the sides of the teeth and the fit is con-

table 1 . . DIMENSIONAL AND EFFECTIVE CLEARANCE

(All readings in tenths of a thousandth of an inch)

Diametral Pitch	CLASS A				CLASS B				CLASS C			
	Dimensional Clearance		Effective Clearance		Dimensional Clearance		Effective Clearance		Dimensional Clearance		Effective Clearance	
	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min	Max.	Min.	Max.
1/2	76	116	5	45	56	91	−15	20	26	61	−45	−10
2.5/5	57	97	5	45	37	72	−15	20	10	45	−42	−7
3/6	52	92	5	45	32	67	−15	20	5	40	−42	−7
4/8 and 5/10	44	84	5	45	24	59	−15	20	3	38	−36	−1
6/12 and 8/16	39	69	5	35	21	51	−13	17	4	34	−30	−0
10/20—20/40	37	62	5	30	21	46	−11	14	2	27	−30	−5
24/48—48/96	37	57	5	25	23	43	−9	11	2	22	−30	−10

Extracted from American Standard B5.15-1950.

table 2 . . ALLOWABLE ERRORS

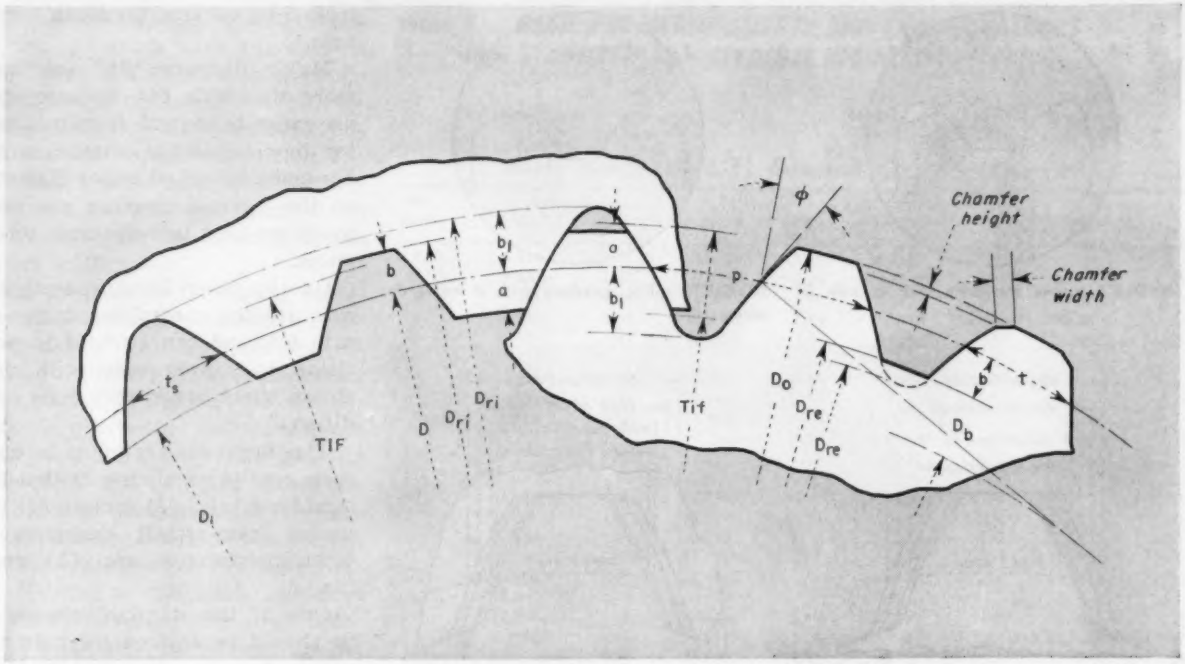
(All readings in tenths of a thousandth of an inch)

Diametral Pitch	Involute Profile Errors	Accumulated Pitch Error Between Any Two Teeth — Number of Teeth													Lead Errors — Length of Spline					
		6	8	10	12	14	16	20	25	30	35	40	45	50	0 to 0.49	0.50 to 1.24	1.25 to 2.49	2.50 to 3.99	4.00 to 5.24	5.25 to 6.50
1/2	15	22	22	22	22	23	24	27	30	33	36	39	42	45	0	4	5	6	7	8
2.5/5	11	20	20	20	20	20	20	20	20	20	21	22	23	24	0	4	5	6	7	8
3/6	10	18	18	18	18	18	18	18	18	18	18	19	20	20	0	4	5	6	7	8
4/8 and 5/10	8	15	15	15	15	15	15	15	15	15	15	15	15	15	0	4	5	6	7	8
6/12 and 8/16	6	15	15	15	15	15	15	15	15	15	15	15	15	15	0	3	3	4	5	6
10/20 Up	5	15	15	15	15	15	15	15	15	15	15	15	15	15	0	3	3	4	5	6

OUT OF ROUNDNESS

Diametral Pitch	Internal Spline — Number of Teeth													External Spline — Number of Teeth											
	6	8	10	12	14	16	20	25	30	35	40	45	50	6	8	10	12	14	16	20	25	30	35	40	45	50
1/2	17	19	21	24	23	23	24	24	24	25	25	26	26	16	18	20	23	23	24	24	24	25	25	25	25	25
2.5/5	13	13	14	15	16	17	18	20	23	23	23	23	24	12	13	14	15	16	17	18	20	22	22	22	22	22
3/6	12	13	13	14	14	15	17	19	20	22	23	24	24	12	12	14	14	15	15	17	18	20	21	21	21	21
4/8 and 5/10	11	12	12	13	13	13	15	16	17	18	20	21	22	10	11	11	12	13	13	14	15	16	18	19	20	21
6/12 through 48/96	9	9	10	10	10	11	11	12	13	14	15	16	17	8	9	10	10	10	11	12	12	14	14	15	16	17

Extracted from American Standard B5.15-1950



FORMULAS FOR AMERICAN STANDARD 30° INVOLUTE SPLINES

FORMULAS	SYMBOLS
$D = N/P$	a = addendum
$D_b = D \cos \phi$	b = dedendum, flat-root
$p = \pi/P$	b_1 = dedendum, fillet-root
$t_b = \pi/2P$	c = clearance
$a = 0.500/P$	Cl = maximum dimensional tooth clearance
$D_o = [N + 1]/P$	d_e = pin diameter, external
$D_i = [N - 1]/P$	d_i = pin diameter, internal
	D = pitch diameter
	D_b = base diameter
	D_i = minor diameter, internal
	D_o = major diameter, external
	D_{re} = minor diameter, external
	D_{ri} = major diameter, internal
	M_e = measurement over pins
	M_i = measurement between pins
	N = number of teeth
	P = diametral pitch (numerator)
	p = circular pitch
	t = circular tooth thickness
	t_b = basic circular tooth thickness
	t_s = circular space width
	TIF = true involute form diameter
	ϕ = pressure angle
	ϕ_e = pressure angle at pin center, external
	ϕ_i = pressure angle at pin center, internal

EXTERNAL FLAT-ROOT

$a = 0.500/P - Cl$

$b = 0.600/P + 0.002$

$D_o = [N + 1]/P - 2\,Cl$

$D_{re} = [N - 1.200]/P - 0.004$

FILLET-ROOT

SIDE FIT

$b_1 = 0.900/P$ for 1/2 to 12/24 DP

$b_1 = 1.000/P$ for 16/32 to 48/96 DP

$D_{re} = [N - 1.800]/P$ for 1/2 to 12/24 DP

$D_{re} = [N - 2.000]/P$ for 16/32 to 48/96 DP

MAJOR DIAMETER FIT

$a = 0.500/P$

$b = 0.600/P + 0.002$

$D_o = [N + 1]/P$

$D_{re} = [N - 1.200]/P - 0.004$

Same as for side fit

INTERNAL FLAT-ROOT

$b = 0.500/P$

$D_{ri} = [N + 1]/P$

FILLET-ROOT

SIDE FIT

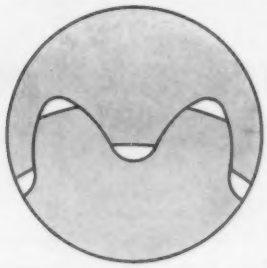
$b_1 = 0.900/P$

$D_{ri} = [N + 1.800]/P$

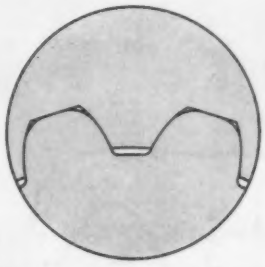
MAJOR DIAMETER FIT

Same as for side fit

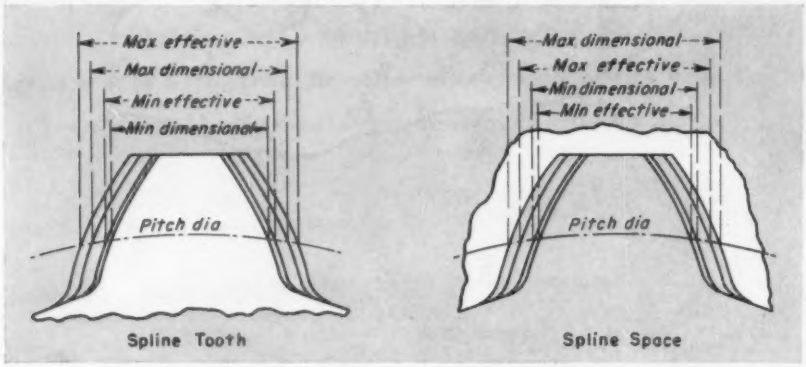
Not applicable



INVOLUTE spline members with a side fit



INVOLUTE spline members with a major diameter fit



COMPARISON of dimensional and effective tooth thickness

table 3 . . MACHINING TOLERANCES FOR SIDE FIT

	Class of Fit	Diametral Pitch	Apply Tolerance to	Tolerance
Circular Tooth Thickness, External	Sliding	1/2 — 5/10	Maximum effective or maximum dimensional tooth thickness	+0.0000 —0.0020
		6/12—20/40		+0.0000 —0.0015
		24/48—48/96		+0.0000 —0.0010
	Close and Press	1/2 —20/40		+0.0000 —0.0015
		24/48—48/96		+0.0000 —0.0010
Circular Space Width, Internal	All	1/2 — 5/10	Minimum effective or minimum space width dimensional	+0.0020 —0.0000
		6/12— 8/16		+0.0015 —0.0000
		10/20—48/96		+0.0010 —0.0000

Extracted from American Standard B5.15-1950

table 4 . . MACHINING TOLERANCES FOR MAJOR DIAMETER FIT

	Class of Fit	Diametral Pitch	Apply Tolerance to	Tolerance
Major Diameter, External	Sliding	All	D_o—.0015	+0.0000 —0.0001 (19+2 D_o)
	Close	All	D_o—.0001	+0.0000 —0.0001 (6+2 D_o)
	Press	All	D_o+.0001 (8+D_o)	+0.0001 (9+2 D_o) —0.0000
Major Diameter, Internal	All	All	$\frac{N+1}{P}$	+0.0001 (7+D_o) —0.0000

Extracted from American Standard B5.15-1950

trolled by varying the tooth thickness.

Major diameter fits are used more than side fits, because they are easier to control. A ground major diameter on the external member and a broached major diameter on the internal member can normally be held to very close tolerances.

On the other hand, spacing errors are the controlling factor on side fits, and can be held to precision tolerances only with mechines which are in very good condition.

The three classes of fit in each case, are: (1) a sliding fit that assembles freely, (2) a close fit that varies from small clearance to light interference, and (3) press fits.

One of the standard classes of fit should be applied for both the major diameter and side fits, regardless of which is the controlling one. For example, a loose side fit is normally used with any class of major-diameter fit, and a loose major-diameter fit is specified when a side fit is desired.

As stated, one hob will cut all classes of fit for both the major-diameter fit and the side fit. Only the depth of cut is varied to obtain the desired fit.

Before one can establish spline fits, it is necessary to use the design formulas given in the American Standard to calculate the required diameter, pitch and length. Application of these formulas provides the basic spline dimensions from which the dimensions for the desired fit are obtained.

In arriving at the actual dimensions for the fit, allowances must be made for inherent errors in manufacture of the parts.

SIDE FIT

Side fit is divided into three classes: loose, close and press, corresponding respectively to Class A, Class B, and Class C. The loose fit is applicable where there are no torque reversals and where eccentricity may be prevalent. Built around basic dimensions, the close fit is for parts that will slide but still operate without excessive backlash. Desired results may re-

How to achieve desired fits for involute splines . . . continued

quire selection of splined members.

For any given pitch and class of fit, there is an established maximum and minimum effective clearance (positive or negative) between the mated members. The clearance is the effective difference between the external spline tooth thickness and the internal spline space width.

In addition to machining tolerances, the effective clearance is influenced by the inherent errors (allowable errors) in manufacturing the parts. *Therefore, the dimensional difference between tooth thickness and space width does not represent the effective clearance.* Table 1 of dimensional and effective clearance is based upon a given amount of effective clearance corresponding to the pitch and class of fit. By using the minimum effective clearance as shown in the table, the maximum effective clearance and the maximum dimensional clearance for a specific pitch and class may be obtained by applying the suggested machining tolerances and 60% of all allowable errors. The values shown were obtained by using a spline having 25 teeth and no lead error.

For all classes of fits, the minimum effective space width of the internal spline is equal to the basic amount determined from the basic relationship for circular tooth thickness, $t_b = \pi/2P$. The class of fit is obtained by varying the tooth thickness on the external part in accordance with the established clearance. To find the maximum effective tooth thickness of the external spline, subtract algebraically the minimum effective clearance from the basic thickness or width, t_b. Notice that Class B and C fits have a minimum effective clearance which is minus, or actually an interference.

By using the maximum effective tooth thickness of the external spline as a starting point, the maximum dimensional tooth thickness can be found by applying the allowable errors, Table 2.

The maximum dimensional tooth thickness of the external spline is equal to the maximum effective tooth thickness minus 60% of the total allowable errors. To obtain the total allowable errors, add the out-of-roundness divided by *E*, Table 5, to the profile, pitch and lead errors. The percentage factor implies that one can normally expect only 60% of the total errors will be effective. When applied to the internal spline, the out of roundness should be divided by *F*, which is also found in Table 5.

The table of allowable errors is based upon the accuracy requirements for Class 3 gears as given by American Standard B6.6-1946 "Gear Tolerances and Inspection." These allowable errors are for the finished parts and may be considered as the average accuracy obtainable on a production basis. Normally, they are the result of machining and heat treatment. The errors given in the table may or may not be representative of those obtained in a particular plant; however, the table is given here to

table 5 . . BASIC PIN MEASUREMENTS AND CHANGE FACTORS FOR STANDARD 30° INVOLUTE SPLINES

$$N \text{ even, } E = \frac{\cos \phi_t}{\sin \phi_w} \qquad N \text{ odd, } E = \frac{\cos \phi_t}{\sin \phi_w} \cos \frac{90^\circ}{N}$$

Divide measurements by diametral pitch (P, numerator)

No. Teeth	External 1.92/P	E	External 1.728/P	E	Internal 1.44/P	F	Internal 1.728/P	F
6	8.8660	1.31	8.3759	1.39	4.3933	1.91		
7	9.6819	1.31	9.1928	1.38	5.2232	1.83		
8	10.8944	1.36	10.3919	1.44	6.3954	1.85	5.2564	6.84
9	11.7535	1.37	11.2509	1.44	7.2618	1.81	6.2313	3.22
10	12.9144	1.41	12.4028	1.48	8.3966	1.83	7.3929	2.76
11	13.8003	1.41	13.2882	1.48	9.2867	1.80	8.3134	2.49
12	14.9295	1.44	14.4108	1.51	10.3973	1.81	9.4332	2.37
13	15.8335	1.45	15.3142	1.51	11.3040	1.79	10.3568	2.26
14	16.9412	1.47	16.4169	1.53	12.3978	1.80	11.4552	2.20
15	17.8584	1.47	17.3329	1.54	13.3167	1.78	12.3851	2.14
16	18.9507	1.49	18.4217	1.55	14.3982	1.79	13.4692	2.11
17	19.8778	1.49	19.3482	1.55	15.3265	1.78	14.4054	2.06
18	20.9584	1.51	20.4256	1.57	16.3985	1.78	15.4790	2.04
19	21.8934	1.51	21.3600	1.57	17.3343	1.77	16.4207	2.01
20	22.9649	1.52	22.4288	1.58	18.3987	1.78	17.4863	2.00
21	23.9062	1.53	23.3696	1.59	19.3405	1.77	18.4328	1.97
22	24.9704	1.54	24.4315	1.59	20.3989	1.77	19.4919	1.97
23	25.9168	1.54	25.3775	1.60	21.3457	1.77	20.4425	1.95
24	26.9752	1.55	26.4339	1.60	22.3991	1.77	21.4964	1.94
25	27.9259	1.56	27.3842	1.61	23.3501	1.77	22.4505	1.93
26	28.9793	1.56	28.4358	1.61	24.3992	1.77	23.5001	1.92
27	29.9337	1.57	29.3899	1.61	25.3538	1.76	24.4573	1.91
28	30.9829	1.57	30.4376	1.62	26.3993	1.76	25.5031	1.90
29	31.9405	1.58	31.3948	1.62	27.3571	1.76	26.4631	1.90
30	32.9862	1.58	32.4391	1.62	28.3994	1.76	27.5057	1.89
31	33.9465	1.58	33.3991	1.63	29.3599	1.76	28.4681	1.88
32	34.9890	1.59	34.4405	1.63	30.3995	1.76	29.5079	1.88
33	35.9517	1.59	35.4029	1.63	31.3623	1.76	30.4724	1.87
34	36.9916	1.59	36.4417	1.63	32.3995	1.76	31.5098	1.87
35	37.9565	1.60	37.4063	1.64	33.3645	1.75	32.4762	1.86
36	38.9939	1.60	38.4428	1.64	34.3996	1.76	33.5115	1.86
37	39.9607	1.60	39.4094	1.64	35.3665	1.75	34.4797	1.85
38	40.9960	1.60	40.4438	1.64	36.3996	1.75	35.5130	1.85
39	41.9645	1.61	41.4120	1.65	37.3682	1.75	36.4827	1.84
40	42.9980	1.61	42.4447	1.65	38.3997	1.75	37.5143	1.84
41	43.9680	1.61	43.4145	1.65	39.3698	1.75	38.4854	1.84
42	44.9996	1.62	44.4455	1.65	40.3997	1.75	39.5155	1.84
43	45.9711	1.62	45.4168	1.65	41.3712	1.75	40.4878	1.83
44	47.0013	1.62	46.4463	1.65	42.3998	1.75	41.5165	1.83
45	47.9740	1.62	47.4188	1.66	43.3725	1.75	42.4901	1.83
46	49.0028	1.62	48.4470	1.66	44.3998	1.75	43.5175	1.83
47	49.9766	1.63	49.4206	1.66	45.3737	1.75	44.4921	1.82
48	51.0041	1.63	50.4476	1.66	46.3999	1.75	45.5184	1.82
49	51.9790	1.63	51.4223	1.66	47.3748	1.75	46.4940	1.82
50	53.0055	1.63	52.4482	1.67	48.3999	1.75	47.5192	1.82

E and F are approximate and are satisfactory only for small changes in tooth thickness. For larger changes, see formulas.

illustrate its application. A recommended table to follow would be one based upon the accuracy obtainable from the plant in which the spline will be produced.

Table 3 shows the suggested machining tolerances for tooth thickness on the external spline and space width on the internal spline. To find the minimum dimensional tooth thickness, apply the tolerances listed in the table to the maximum dimensional tooth thickness. The numerical sum of the tolerances on tooth thickness and space width is numerically equal to the algebraic difference between the maximum and minimum effective clearance.

The following expressions show the relationships between the various tooth thicknesses and space widths for all classes of fits. Machining tolerances and clearance should be algebraically applied.

External Spline

Maximum effective $= \frac{\pi}{2P}$ – minimum effective clearance.

Maximum dimensional = maximum effective –60% allowable errors.

Minimum dimensional = maximum dimensional + machining tolerance. (Table 3)

Minimum effective = maximum effective + machining tolerance.

Internal Spline

Minimum effective $= \frac{\pi}{2P}$

Minimum dimensional = minimum effective + 60% allowable errors.

Maximum dimensional = minimum dimensional + machining tolerance. (Table 3)

Maximum effective = minimum effective + machining tolerance.

MAJOR DIAMETER FIT

As with the side fit, there are three classes of major diameter fits, i.e., Class I, Class II, and Class III. Respectively, they correspond to the loose, close and press fit. The major diameter fits may be compared to cylindrical fits in which the major diameter of the external member is ground to control size for the desired fit. For all classes of fits, a chamfer on the top of the teeth of the external spline is recommended. When possible, a broached internal spline is recommended, because a broach will normally produce an accurate major diameter. Except for cases where violent torque reversals are present, the side fit should be from the loose classification, Class A.

To obtain any one of the three fits, the major diameter of the internal spline should be $(N + 1)/P$. The major diameter of the external spline should be one of the following, depending upon the fit desired:

Class I — Major diameter $= \frac{N+1}{P} - 0.0015$

Class II — Major diameter $= \frac{N+1}{P} - 0.0001$

Class III — Major diameter $= \frac{N+1}{P} + 0.0001\left[8 + \frac{(N+1)}{(P)}\right]$

Table 4 gives the suggested machining tolerances that can be applied to the major external and internal diameters.

OVER-PIN MEASUREMENTS

The best available method of determining dimensional tooth thickness or space width is by using two pins and measuring the distance over or between them. Maximum and minimum pin measurements are determined by using the maximum and minimum dimensional tooth thickness and space width. Pin measurements may be calculated according to the formulas:

External Spline

$$\text{inv } \phi_e = \text{inv } 30^\circ + \frac{d_e}{D_b} + \frac{t}{D} - \frac{\pi}{N}$$

When N is even:

$M_e = D_b \sec \phi_e + d_e$

When N is odd:

$M_e = D_b \sec \phi_e \cos \frac{90^\circ}{N} + d_e$

Internal Spline

$$\text{inv } \phi_i = \text{inv } 30^\circ + \frac{t_s}{D} - \frac{d_i}{D_b}$$

When N is even:

$M_i = D_b \sec \phi_i - d_i$

When N is odd:

$M_i = D_b \sec \phi_i \cos \frac{90^\circ}{N} - d_i$

The maximum and minimum pin measurements can also be determined from Table 5. The pin measurements shown are for basic tooth thickness and space width. To determine the actual dimensional pin measurements, divide the appropriate table value by DP (numerator) and find the required change in pin measurement, which depends upon the amount that the teeth or spaces are thicker or thinner than basic. The change may be found according to the following relationships:

Internal Spline

change in pin measurement = $F \times$ (change from t_b)

External Spline

change in pin measurement = $E \times$ (change from t_b)

Although pin measurements are a reliable method to find size, fits cannot be controlled by tooth thickness and space width alone. If allowable errors were eliminated, the effective fit could be determined directly from pin measurements. Because of the unavoidable errors obtained as a result of machining and heat treatment, the clearance that may be indicated by pin measurements is not the effective clearance. Therefore, the maximum external or minimum internal pin measurements should not be the basis for rejection so long as effective size, controlled by gages, is not beyond the specified maximum or minimum.

To inspect the effective size of either an internal or external spline, a composite plug or ring gage should be used. Primarily, the Go composite gage is used to check either the minimum effective space width or the maximum effective tooth thickness. The Not Go composite gage is used to check the maximum effective space width or the minimum effective tooth thickness. Gages are also available for checking dimensional tooth thickness, dimensional space width, and major diameter. For a complete discussion of involute spline gaging, refer to American Standard B5.31-1953.

Why living improves . . . in America

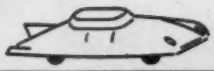
Doorway to a better tomorrow

Industries are built over this keystone, creating our abundant food, clothing, housing and luxuries

American Machinist

SPECIAL REPORT

NUMBER 397



INDUSTRIAL REVOLUTION since 1800 BASIS OF MODERN CIVILIZATION

POWER
Steam Engine—1770 AD
Modern Steam Turbine—1799 AD
Francis Waterwheel—1849
Pelton Waterwheel—1884
Gas Engine—1860
Diesel—1897

MACHINE TOOLS
Screw-cutting Lathe—Maudslay, 1797
Boring Machine—Wilkinson, 1808
Profile Lathe—Blanchard, 1819
Endless Bandsaw—Newberry, 1808
Milling Machine—Whitney, 1818

ELECTRICITY
Thales—640-546 BC
Dufay—1698-1739 AD
Franklin—1706-1790 AD
Cavendish—1731-1810 AD
Volta—1745-1827 AD

INTERCHANGEABILITY
Measurement—Egypt (?)
Pulley Blocks—Bentham, 1791
French attempts—1717, 1785
Muskets—Whitney, 1809
Loom—Jacquard, 1805

STEAM
Turbine—Ctesibus (Egypt)—150 BC
Modern—1799
Boiler (Haycock)—1708 AD
Engine—Mathesius—1571 AD
Newcomen—1705 AD
Condenser—Watt—1769 AD

QUANTITY PRODUCTION
Water Mills—Rome, 25 BC
Spinning Jenny—Hargreaves, 1770
Grist Mill—Evans, 1785
Cotton Gin—Whitney, 1792
Improved Loom—Slater, 1801

MECHANICAL TRANSMISSION
Wheel—Egypt—Before 5000 BC
Winch—Babylonia—2000 BC
Gears—Rome—16 BC
Corn Grinder—England—1191 AD
Centrifugal Pump—Da Vinci—1490 AD

BASIC PHYSICS
Light—Romer, 1644-1710
—Herschel, 1738-1822
Time—Ptolemy, 70-147 AD
Bacon, 1214-1294 AD
Laws—Boyle, 627-91 AD; Hook, 1635-1703; Newton, 1642-1727
Mass—Archimedes, 287-212 BC
Trig—Pythagoras—6th Cent BC

USE OF ELEMENTS
Earth—Clay for Vessels—Prehistoric
Wind—Egyptian Windmills—150 AD
Water—Mills in Rome—85 BC
Pit Wheel—1568 AD
Fire—Egypt temple—150 BC

METALLURGY
Silver & Gold Ornaments—8000 BC
Copper Tools—6000 BC
Meteoritic Iron Tools—5000 BC
Iron—3500 BC
Brass Alloys—2000 BC
Smelter—1620 AD Furnace—1750 AD

USE OF ANIMALS
Man—30 to 50 ft lb/sec
Ass—110 ft lb/sec
Ox—300 ft lb/sec
Horse—400 to 500 ft lb/sec
1000 BC—1800 AD

USE OF TOOLS
Hand Axe
Digging Stick
Spear
Rasp & Saw
50,000 to 5,000 BC

USE OF FIRE
Firebrand
Fire making
Lamps
Cooking
50,000 to 10,000 BC

THE GREAT CHANGE
Man evolved with a brain, eyes with stereoscopic vision, hands with opposed thumbs. When man combined these with a sharp stone as a tool, he moved out from the other animals
One Million BC to Date

Before history, Nature preserved in each generation of men those individuals who succeeded best in correlating brain, eyes, hands, and tools. Thus man developed, through a million years.

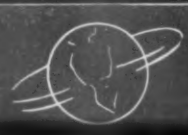
Only 8000 years ago did man begin to use bronze. Three thousand years later, he used iron—but his tools were still sharpenable copies of his stone ones.

Not until 150 years ago, after 99% of man's evolution, did he begin to use power tools. His brain had tripled in size, his hands were skilled, his eyes phenomenal in their ability to adjust. So man sought ways to live more easily.

This past century and a half, he has found them, at an ever-increasing rate. Now he bends many forms of power, many kinds of tools, to his will. He is no longer the slave, but the master, of his environment.

Here, and on succeeding pages, we picture this accelerating growth. It is proper that we should, so recent developments may be seen in proper perspective. Current advances are frequently amazing — but they are the logical outgrowth of the ever-faster pace of our advancement. This will be obvious at the forthcoming Chicago Shows, where eight years of progress will be on display—the most startling eight years in man's history.

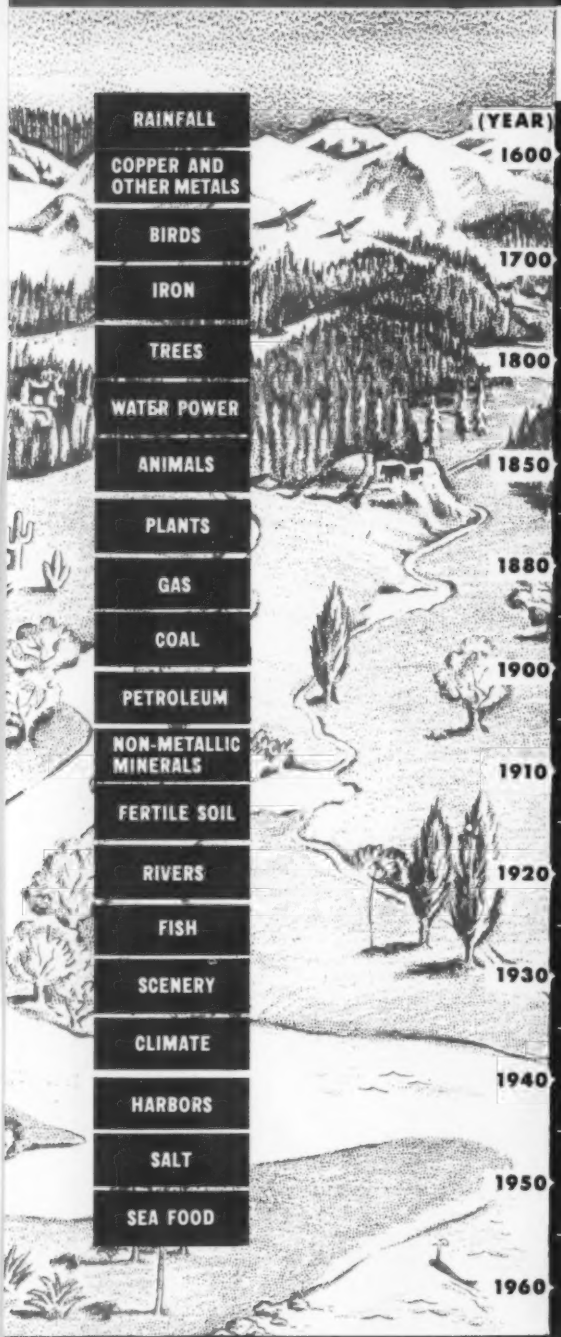
—E J Tangerman
Executive Editor



PREHISTORIC IGNORANCE

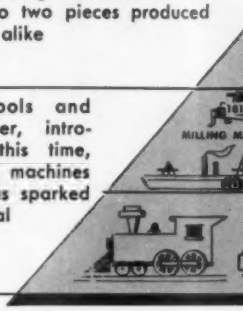
Why living improves...in America

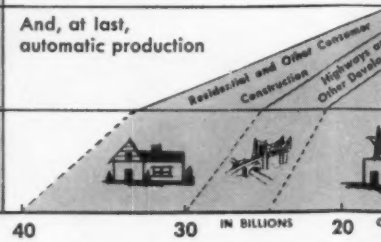
NATURAL RESOURCES + ENERGY X TOOLS



These are our natural resources—all worthless to man until energy and tools are applied to convert them to goods and services

Energy Supplied MEN	Energy Supplied ANIMALS	MACHINES	
18%	82%	0%	For milleniums, man had only these hand tools, so was limited in his output, no matter how hard or how long he worked. Living was difficult and poor, and no two pieces produced were exactly alike
17%	81%	2%	
16%	80%	4%	Machine tools and steam power, introduced at this time, made other machines possible, thus sparked the Industrial Revolution
15%	79%	6%	
12%	58%	30%	Here the factory system entered American industrial development
10%	52%	38%	
8%	47%	45%	
5%	30%	65%	
4%	12%	84%	Here, mass production and assembly lines began to take effect
4%	10%	86%	
4%	4%	92%	And, at last, automatic production
3%	1%	96%	



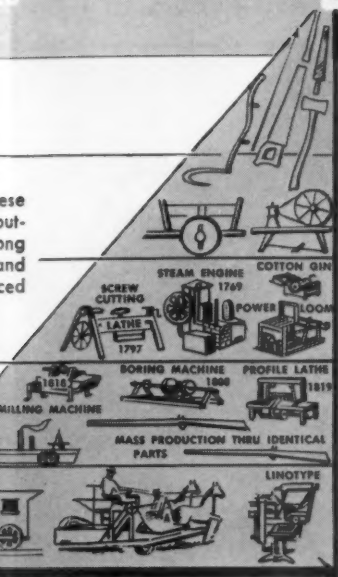


Once all energy applied to serving man was human, now most of it is mechanical. Here, decade by decade, are the advances since 1600.

First, only hand tools. Then, power tools . . . Thus began our prese Then came the "factory system", ment in such tools grew, decade did our standard of living.

American Machinist • July 4, 1955 pages 117-124

MAN'S MATERIAL WELFARE



Only 6% of the world's population lives in the United States. Yet we have 76% of all the automobiles in the world, we have 58% of the world's telephones, we have 40% of the world's electric products, we have 27% of the world's newspapers, etc. The reason for this fantastic superiority in our material welfare is shown in the adjoining columns.

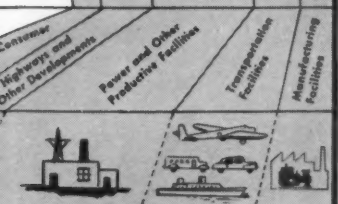
The increase in output per hour of work has averaged 18% greater for each ten years since 1850!

This spectacular increase in output per hour of work is the result entirely of constantly installing new and better "tools". Only by continuing to do so can we continue to make more things available for more of our people. Tools produce the greatest good for the greatest number. As we increase our efficiency of their use, we gain more material things, more leisure and health, and our hours of labor as well as the amount of our toil, declines (right-hand column)

1600	80 hr. weekly	
1700	75 hr. weekly	
1800	70 hr. weekly	3 Mil. Employed; Goods per Hr. 27c worth
1850	70 hr. weekly	10 Mil. Employed; Goods per Hr. 27c worth
1880	66 hr. weekly	17-1/3 Mil. Employed; Goods per Hr. 39c worth
1900	60 hr. weekly	29 Mil. Employed; Goods per Hr. 56c worth
1910	58 hr. weekly	37-1/3 Mil. Employed; Goods per Hr. 62c worth
1920	54 hr. weekly	41-1/3 Mil. Employed; Goods per Hr. 70c worth
1930	47 hr. weekly	45-1/2 Mil. Employed; Goods per Hr. 82c worth
1940	43 hr. weekly	47-1/2 Mil. Employed; Goods per Hr. 97c worth
1950	40 hr. weekly	58-1/2 Mil. Employed; Goods per Hr. $1.21 worth
1960	38 hr. weekly	? Mil. Employed; Goods per Hr. $1.61 worth

These lines indicate investments made in the various kinds of capital goods known as "Tools".

These Lines Indicate The Increase in "Personal Income" and What Americans Spend For Their Various Kinds of Goods & Services.



20 OF DOLLARS 10 — 250 200 IN BILLIONS 150 OF DOLLARS 100 50 — IN BILLIONS OF DOLLARS

Only if tools are available to multiply natural resources and energy, can we turn out more of the things we need and want. Tools are the only factor in the equation that can be changed.

Our American civilization provides more and better living than any in the history of the world—because ours is based on production facilities. This symbolic tree pictures the recent growth. Only 150 years ago, we had nothing but the roots. Then began the growth of the trunk—machine tools—and the branches inevitably followed. These branches are the implements and facilities for power, production, transportation, banking—from steel mills to printing presses, farm tractors to skyscrapers, from tiny screws to great turbines. All depend on powered tools for their making.

We are sharing the harvest, pictured beneath the tree—the goods, comfort, and leisure for an ever-increasing population. But only as the "tree" grows larger and stronger can we have more "fruit."

The Harvest from Tools

A tool is but the extension of a man's hand and a machine is but a complex tool.

And he that invents a machine augments the power of a man and the well-being of mankind.

Henry Ward Beecher

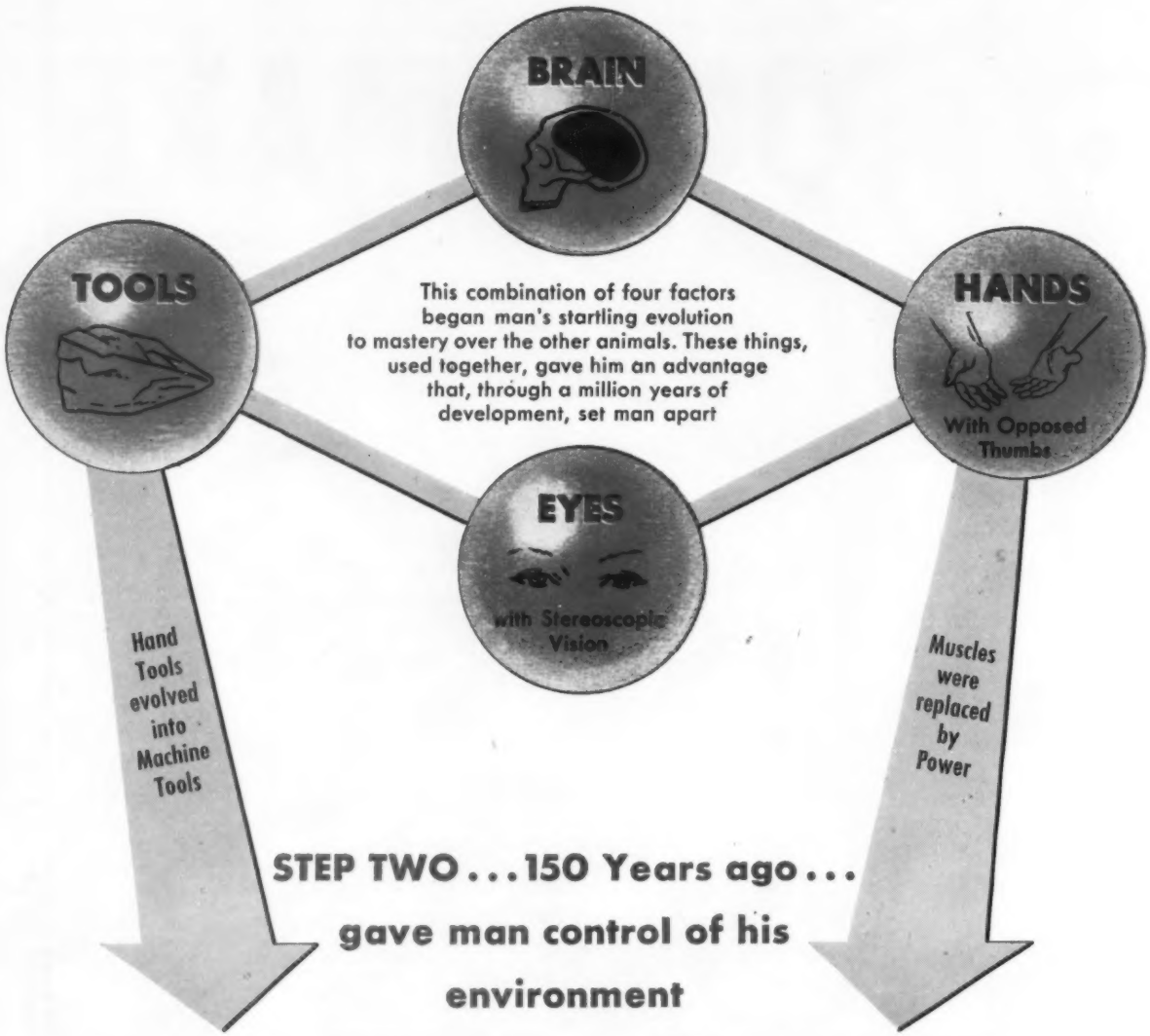
From a chart prepared by the Wilkie Foundation, Des Plaines, Ill.

Additional copies of this insert are available from Reader Service Dept, American Machinist, 330 West 42nd St, New York 36, NY. Price 25 c

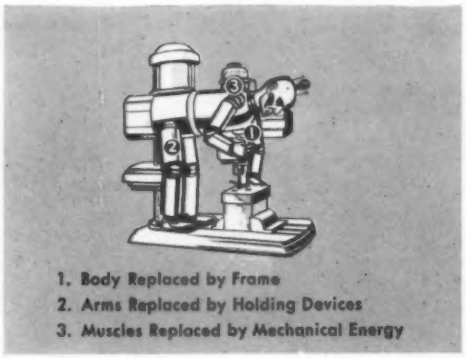
TOOLS MAKE AMERICA GREAT

Our American civilization provides more and better living than any in the history of the world—because banking—from steel mills to printing presses, farm

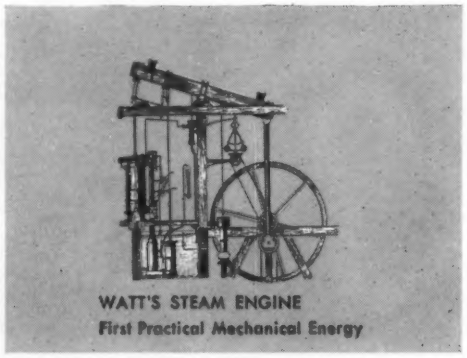
STEP ONE . . . a million years ago . . . produced man


BRAIN
TOOLS
HANDS
With Opposed Thumbs
This combination of four factors began man's startling evolution to mastery over the other animals. These things, used together, gave him an advantage that, through a million years of development, set man apart
EYES
with Stereoscopic Vision
Hand Tools evolved into Machine Tools
Muscles were replaced by Power

STEP TWO . . . 150 Years ago . . . gave man control of his environment



1. Body Replaced by Frame
2. Arms Replaced by Holding Devices
3. Muscles Replaced by Mechanical Energy



WATT'S STEAM ENGINE
First Practical Mechanical Energy

STEP THREE . . . to automate production . . . is now eliminating drudgery, freeing man at last to enjoy the benefits of our civilization

—A CIVILIZATION BUILT ON TOOLS

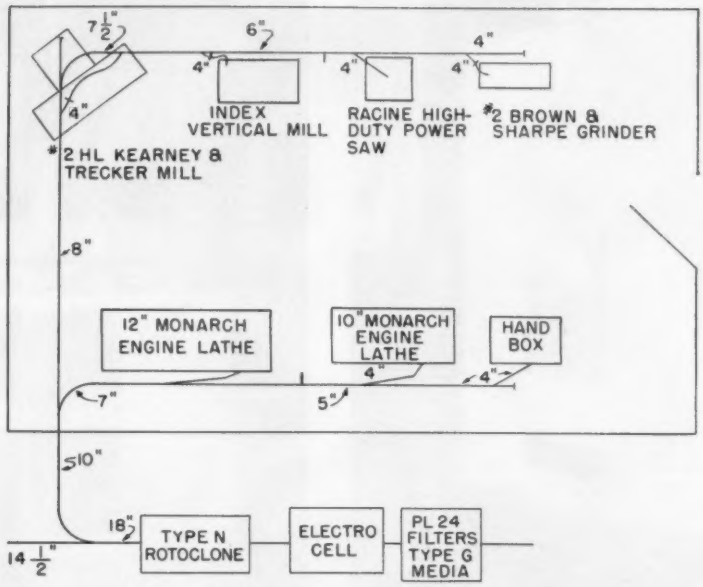


FIG 1.. Beryllium machining is done in one room, laid out this way. Diameters of exhaust ducts are shown

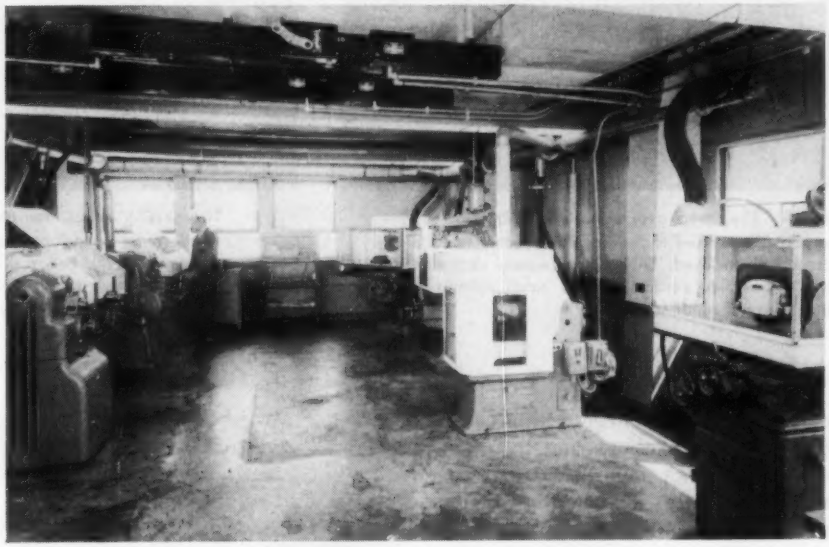


FIG. 2.. From the door, the beryllium room looks like this. The hood on the B & S surface grinder (far right) rides on the grinder table. Front access windows slide laterally. A screen at left reduces static pressure when access windows are closed; within it, coolant sprayed throughout the hood. To make table movement easier, a ¼-in. steel plate is slipped over the spindle (with the grinding head off), and slides within the double back wall. The whole enclosure moves out with crossfeed, the plate sliding along the spindle

Toxic materials machined safely

Hoods modified as a result of experience at Argonne. Here are details on precautions when machining beryllium—what has been learned since the *AM* 1951 report

DONALD P O'NEIL, assistant industrial hygienist
ARGONNE NATIONAL LABORATORY, LEMONT, ILLINOIS

Of all the non-radioactive materials handled daily at various atomic-energy installations, beryllium has probably elicited more concern than any other. Along with the favorable physical characteristics that brought it into prominence, there is an undesirable toxic problem whenever beryllium undergoes chemical or mechanical treatment which permits it to become airborne and respirable.

Beryllium as the metal or as a compound can manifest its toxic effects on the body in several different ways, as a skin reaction

FIG 3 . . The hood over the 10 x 10-in. Racine power saw is a box fixed to the base and frame so all moving parts are enclosed. Safety-glass access doors on front and sides slide vertically, have small catches to hold them open if required

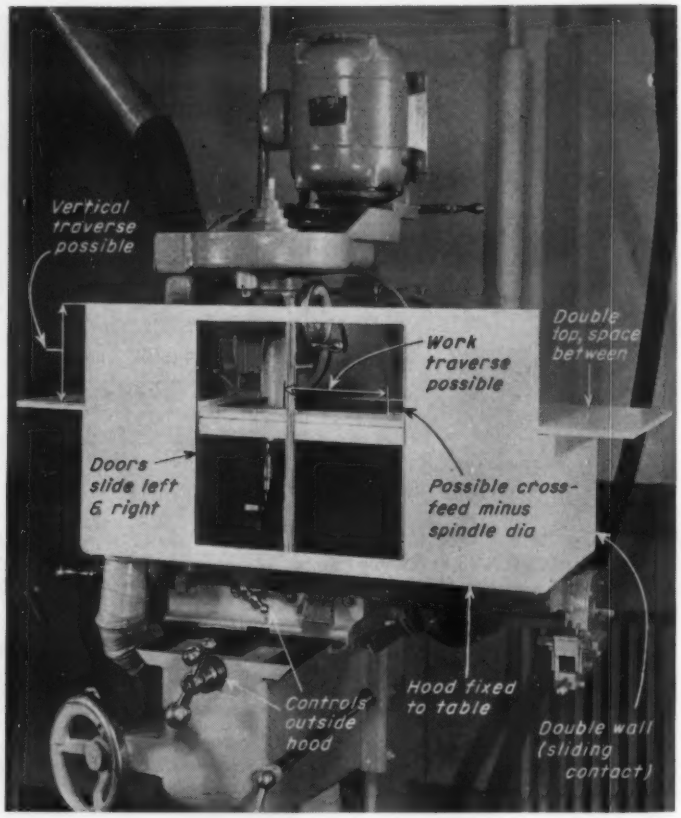


FIG 4 . . .Two nesting boxes, one fixed to the spindle with open bottom and front, the other fixed to the table and open on top, hood the Index vertical mill. For either horizontal motion, the plate fixed to the spindle slides within the double-walled hood top as the one does on the back of the grinder. Safety-glass access doors slide laterally within the double-walled front

or as an acute or chronic lung condition. Skin reactions and injuries are usually not severe and can be treated readily. The acute illness involving the lungs may vary from a mild bronchitis to severe pneumonia and usually develops within hours after exposure. The chronic lung condition may develop from months to years after exposure.

There have been cases of chronic berylliosis reported* among residents of a community in the vicinity of a commercial beryllium-producing plant where it was estimated the average concentration of beryllium over a seven-year period was less than 0.1 micrograms per cubic meter of air. One case was a woman, residing 1¾ miles from the plant, whose husband was employed in a beryllium plant; it is believed her exposure occurred in the handling of her husband's work clothes.

In light of this information and considerable supplementary data, a committee appointed by the U S Atomic Energy Commission made these recommendations March 30, 1950, for the control of beryllium hazards for AEC contractors:

1. The in-plant atmospheric concentration of beryllium at beryllium operations should not exceed 2 micrograms per cubic meter as an average concentration throughout an 8-hour day.

2. Even though the daily average might be within the limits of Recommendation #1, no personnel should be exposed to a concentration greater than 25 micrograms per cubic meter for any period of time, however short.

3. In the neighborhood of an AEC plant handling beryllium compounds, the average monthly concentration at the breathing-zone level should not exceed 0.01 micrograms per cubic meter.

These recommended levels had been in effect at Argonne for two years prior to publication and were the principal considerations in setting aside a separate room for beryllium operations when the machine shops were moved to their present location. All machines necessary to any contemplated beryllium work were placed in this room (Fig 1). They were then enclosed in bellows-type hoods of an impervious fabric with Lucite windows and sliding ports for visibility and access. This work was described in *AM*, Feb 19, 1951, in an article by S S Gold, "Hooded Machines Run Toxic and Radioactive Jobs."

Shortly after the hoods were put into general use, scratches from flying particles and from the sliding action of the small access doors began to appear in the Lucite,

*Eisenbud, M; Wanta, R C; Dustan, C; Steadman, L T; Harris, W B; and Wolf, B S: "Non-Occupational Beryllosis," AECU-201 (NY00-53) J Ind Hyg Toxicol 31, 282-94 (1949).

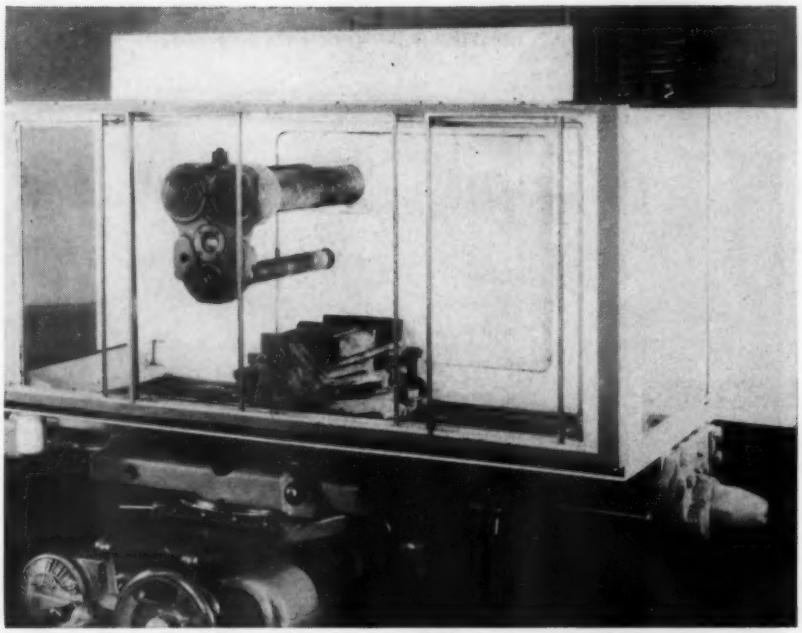


FIG. 5 . . The hood for the K & T mill is basically the same as that for the grinder. It rides on the table and has a double-walled back, within which a steel plate slides for traverse or vertical feed, while it slides along the shaft for crossfeed. Access doors slide within a double-walled safety-glass front

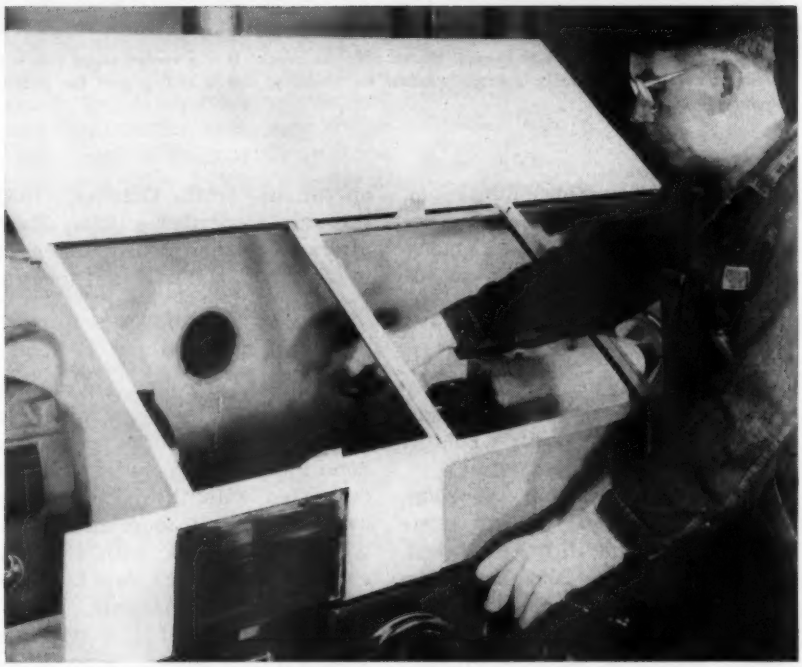


FIG. 6 . . Both lathe hoods are fixed to headstock and bed, have access windows that slide up and back into an envelope. Windows can be held open by a catch. Hood front below the windows is a series of sections fixed to the carriage that can telescope as carriage moves along bed

slowly reducing visibility. Within two years, in addition to the then poor visibility through the Lucite windows, the hood fabric had deteriorated to such an extent that complete replacement of the hoods became necessary. (At no time were the men exposed to concentrations in excess of the recommended values as a result of hood deterioration.)

In approaching the design of new hoods, five primary considerations were guides. In order of importance they were: protection, visibility, economy, hood life, and machine flexibility.

Construction of hoods was placed in the hands of Alexander Denst, machine-shop foreman, who was entirely familiar with beryllium machining techniques and with the stringent health and safety requirements of the laboratory with regard to control of resultant dust. However, to assure the protection required and the air-flow patterns desired, a close liaison was maintained between Industrial Hygiene & Safety Division and foreman.

Hoods were fabricated one at a time, tested for air flow, ease of manipulation, visibility, and flexibility of machine, and revised if necessary before construction of the next was started.

Before each machine was worked on, the old hood was carefully removed and wrapped in sheet

plastic, and the machine thoroughly cleaned. Smears were then taken to determine the extent of remaining contamination. With this approach, only one machine was out of commission at any one time, work was carried on safely, and machining operations were impeded only to the extent that other machines could not be adapted to do the work usually done with the machine that was down.

FIG. 7 . . For hand work, a box hood is placed over the bench. It is a vented metal box with sliding access or hand ports, a large window for visibility, and a sliding port for passing equipment in and out

HOOD DESIGN

In general, hoods are constructed of 1/16-in. sheet metal, ¼-in. steel plate where rigidity or high strength is necessary, and steel-framed safety glass wherever visibility is required. The various sections of the hoods are machine bolted, excepting a few locations on the vertical-mill hood (Fig 4) where some welding was done to facilitate the sliding contact of various sections. No gasketing was necessary because of the high static pressure in the hood and the resultant high inward air flow through all cracks and openings. Access doors on all hoods, except the grinding and saw hoods and the dry box, slide into envelopes, thereby preventing the hands from touching surfaces that had been exposed to beryllium. The grinding saw and dry-box hoods are now being equipped in a like manner. In addition, the envelopes or slots effectively contain any beryllium that might have impinged on the closed access windows, then fallen off when the windows were opened.

AIR-CLEANING SYSTEM

The air cleaning system is essentially the original one, consisting of an American Air Filter Type N Rotoclone followed by an Electro Cell electrostatic precipitator and a bank of PL 24 filters and, of course, all necessary connective ductwork. Considerable unnecessary flexible ductwork has been eliminated, however, and some branch sizes have been readjusted. Three short sections of flexible duct are still used to tie in the movable hoods, ie, the Kearney & Trecker mill hood, the Index vertical-mill hood, and the Brown & Sharpe surface-grinder hood.

The system, which also exhausts air from a uranium-grinding room, was considerably overdesigned originally as far as blower capacity is concerned and remains so today. However, the overdesign, although a bit less economical than a simple control design, is beneficial in that it increases velocity through the face of the open hoods, making for a more positive control than would normally exist.

Total air flow from the room with any one hood window completely open and all others closed, is approximately 2000 cfm at a static pressure of 7.5 in. H_2O in the system, at a point just outside the room. Maximum air flow through any one hood occurs through the saw hood, a total flow of 700 cfm which leaves a leakage of 1300 cfm through the entire system (see table).

Efficiency studies of the air-cleaning equipment indicate efficiencies of approximately 99.15% are being realized. Data for the study were gathered from 27 simultaneous isokinetic air samples taken on the up- and down-stream sides of the cleaning equipment with MSA High Vol Type "S" filter media during beryllium-machining operations from October, 1953, through December, 1954. These filters were then ashed, taken up in nitric acid and analyzed spectrographically.

ROOM AIR SAMPLES

As a matter of policy, air samples were taken in the beryllium room whenever any work was being done there. This included all work connected with the hood change-over and routine room cleaning as well as the work with the machines. The samples were taken, as nearly as was possible, in the breathing zone of the operator, with a Filter Queen using Whatman #1 filter paper. These papers were then analyzed spectrographically. Average concentration in the room was 0.13 micrograms per cubic meter of air, or about 6% of the recommended safe level.

Routine sampling in the room will continue, in spite of the overwhelming evidence indicating sufficient control, for these reasons:

1. To assure proper operation of the exhaust system.
2. Record exposures in case of an accident.
3. Encourage adherence to regu-

lations governing work in the room.

4. Maintain confidence in the minds of the workers with regard to the safety of the work.

DECONTAMINATION

To prevent accumulation of any beryllium that might have gotten out of the hoods or have been spilled, the room is thoroughly wet-mopped once each week if used since the last cleanup. The wash solution is then analyzed and smears are taken of the floor throughout the room to determine the effectiveness of the cleanup.

In addition, hoods are vacuumed following each job to remove the dust and chips that have accumulated. Flexible 2-in.-ID vacuum hoses are in integral part of the exhaust system, one being taken off at about the center of the main branch ducts down each side of the room. The hoses are long enough to reach the farthermost section of any hood on the same side of the room, and when not in use are clipped in place, as shown in Fig 2.

OPERATING RULES

To control operations within the beryllium room and thereby assure a maximum of safety, these regulations are rigidly enforced:

1 . . The exhaust system will be on during all work in the room

2 . . Air samples will be taken during all work in the room

3 . . Smoking or eating within the room is not permitted

4 . . All hoods will remain closed when not in use

5 . . Hood in use will be kept closed except when it is absolutely necessary that it be open

6 . . Beryllium will be handled with gloves

7 . . All wastes (ie, rags, paper, Kleenex, gloves, etc) will be discarded into cardboard containers within the room, which will be capped and sealed before removal for special treatment

8 . . Hoods will be cleaned upon completion of each job

9 . . Work clothes will be turned in for laundering at the end of each work day

10 . . Room will be wet-mopped Wednesday if any work has taken place since the previous Wednesday.

Reduction in Machining Capacity with Hoods*

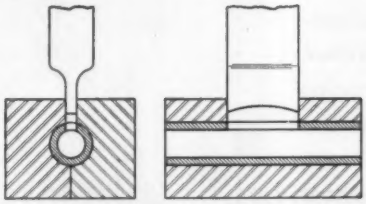
		Crossfeed, in.	Work Traverse in.	Vertical in.	Access Opening (one window) sq ft	Avg Face Vel, ft/min
#2 Brown & Sharpe	Normal Design	8	14	8	1.65	275
	With Hood	5	9	5		
#2 HL Kearney & Trecker Milling Machine	Normal Design	13¾	30	19	1.12	550
	With Hood	7½	15	8		
Index Vertical Mill	Normal Design	8	16	16	1.31	275
	With Hood	4½	11	7		

		Between Centers, in.	Swing, in.	Access Window (one window) sq ft	Avg Face Vel, ft/min
12" Monarch Engine Lathe	Normal Design	30	14½	1.78	275
	With Hood	10	12		
10" Monarch Engine Lathe	Normal Design	20	12½	1.80	275
	With Hood	8	12½		
Racine High-Duty Power Saw				1.74	500

No request for beryllium work has been refused because of the loss of machine flexibility.

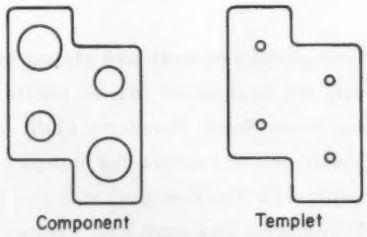
Diemakers Kinks

FEDERICO STRASSER

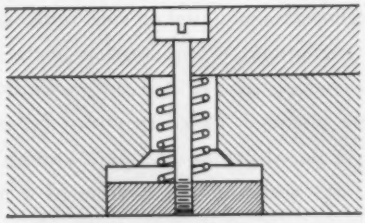


TUBE SLOTTING is practical with a die-less tool, if the tubing is thick-walled. The tube is gripped tightly by two close-fitting jaws, and the slot is cut with a hollow-ground punch.

CURLING of the open ends of round shells is not difficult if the diameter of the curl is at least four times the stock thickness.



HOLES IN TEMPLETS for progressive dies need not be the same diameter as those in the actual workpiece. It is enough to locate the centers accurately. Large holes in thin templet stock are difficult to drill, and they are never truly round.



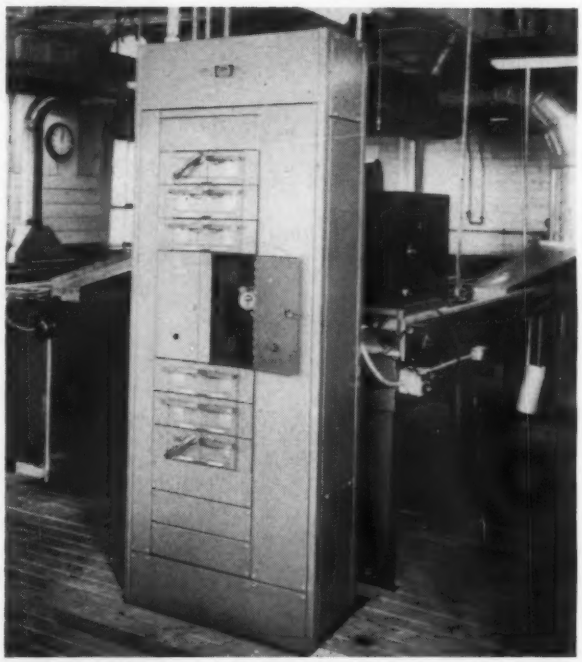
SPRING POCKETS should have a generous chamfer to avoid pinching a compression spring between pad and stationary member.

Efficient layout of the plating department . . .
. . . promotes smooth flow of production. Ventilation system has capacity of 9000 cfm and is connected to water wash on roof

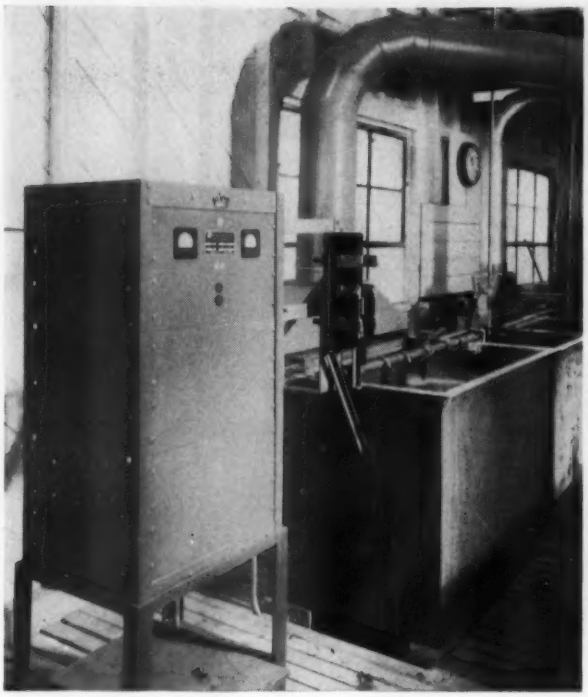
Accurate plating meets

Both plating current and plating-tank temperature are kept under precise control at the Helipot Corp, South Pasadena, Calif, maker of precision potentiometers for military and civilian customers. The firm does still and barrel plating in cadmium and gold, plus passivating and Alumiliting in clear, black, blue and green. Careful positioning and design of the tanks and power supply makes the flow of production convenient for operators.

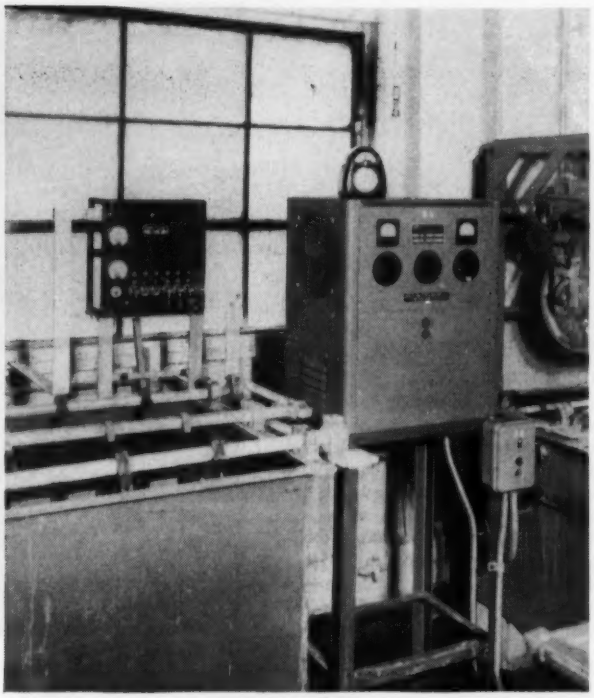
Dc rectifiers are spotted at each plating tank, so accurate control over current is achieved. Rheostats mounted on each tank control voltage; thermostats the immersion heaters. Tank-heating facilities are tied into a timing mechanism on a control panel, so tank temperature can be regulated during the night and on weekends. A clock shuts off the heaters at 4 pm and turns them on again at 5 am.



Tank heaters . . .
. . . are automatically shut off at 4 pm, turned on again at 5 am, by a centralized temperature control panel with timer



Each tank . . .
. . . has its own rectifier to provide dc in needed amount for the operation being done—plating, Alumiliting or passivation

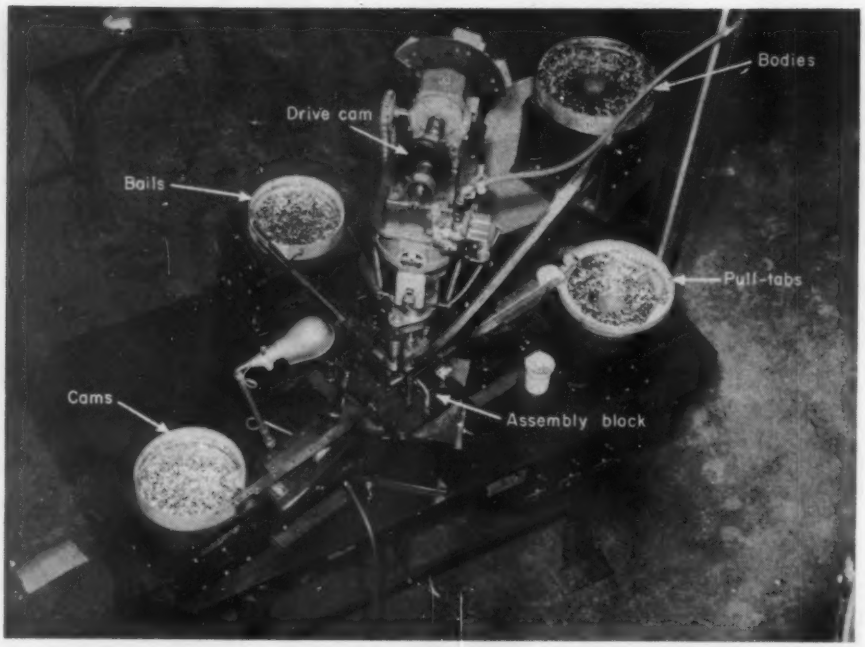


Rheostat at cadmium plating tank . . .
. . . controls the voltage. Temperature is controlled by thermostat

customer specs

Three types of tank material . . .
. . . are used—stainless steel for dyeing operations, glass fiber for acid and acid rinses, and lead-lined for anodizing

pH control . . .
. . . of dyes and sealants is constantly checked with a Beckman meter



Assembly machine . . .

. . . combines four parts, fed from surrounding bowls, to produce slide-fastener slider. Completely automatic, machine turns out 100 units per minute. Built around a drillpress head, machine cycle is actuated by bail entering pull-tab and slider cam. Drive cam moves mandrel down to add body component and spin head on bail; also controls cycle and safety devices

AUTOMATIC ASSEMBLY:

Simple setup, smart positioning produce

Along with the rising trend of automatic machining comes a logical interest in automatic assembly. At present, more manual labor is expended putting parts together than in making them. But very little information or experience is available in this blossoming field. Here are some ideas from one company that is doing a good job

PATRICK J BRUNO, works manager, SIMMONS FASTENER CORP, ALBANY, NY

Have you ever had a slide-fastener slider jam on the edge of a favorite sweater or a good sport shirt? Annoying, isn't it? Frequently, pulling it loose ruins either the fabric, the fastener, or both. Well, the same problem bothered our president, C A Simmons, Sr, and he decided to do something about it. The result of his irritation was a new design of slider, which we now are patenting and which has been given the copyrighted name, "Relees-It."

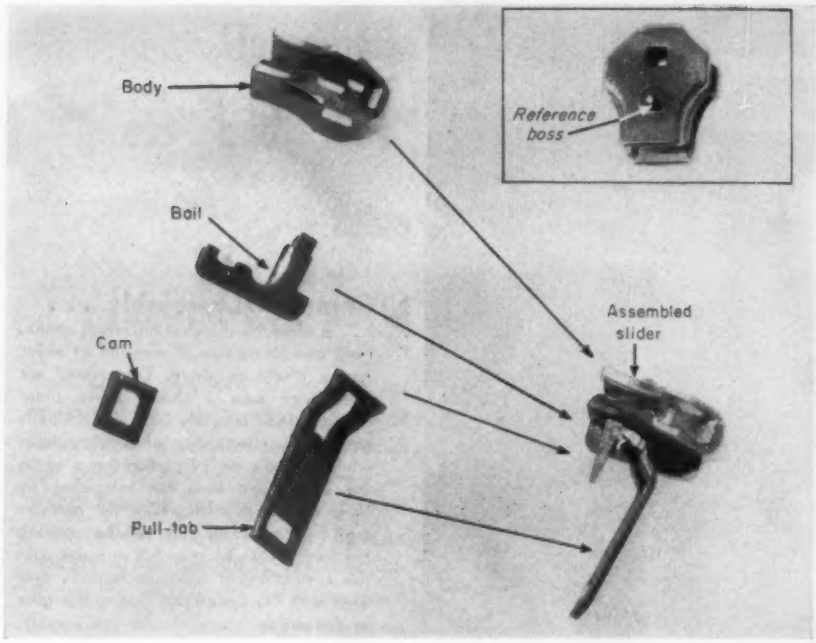
This new slider is used with conventional slide fasteners but it contains a cam that permits the user to open the jaws just enough to release fabric caught between the body and the teeth. Depressing the cam returns the jaws to normal operating position without affecting the fastening action. Mr. Simmons turned the design over to the men in the shop and said, "Make a machine that will produce this thing at a price competitive with other sliders on the market."

Here was an enjoyable challenge, somewhat out of the ordinary nature of our machinery construction. Everybody, including toolmakers, machinists, electricians, and assemblers, pitched in. Brainstorming sessions were frequent. Finally, after a slight change in the design to reduce the number of components to four, a successful automatic machine was developed.

Mounted on a steel table, the machine is built around a Walker-Turner drillpress head. From four vibrating-bowl feeders, it supplies the four components synchronized to meet simultaneously at the assembling point and then, after assembly, it spins over the bail to fasten the parts together.

Internally, each bowl is designed to properly feed a specific component and is precisely built. Bowl vibration is carefully regulated. Thus, each part feeds in the correct position for assembly and with maximum forward pressure into a slide which also is vibrated to increase the forward pressure.

Feeding from opposite ends of the table, the cam



Assembled slider . . .
. . . consists of body, bail, cam, and pull-tab. Parts must be accurately sized and burr free. Orientation for assembly is determined by specific part characteristics; occurs as part is fed from bowl to feed chute. Latter is given twist in some cases to deliver part to assembly block properly positioned. Because both faces of body are identical, except for holes, reference boss was added to one face to simplify identification

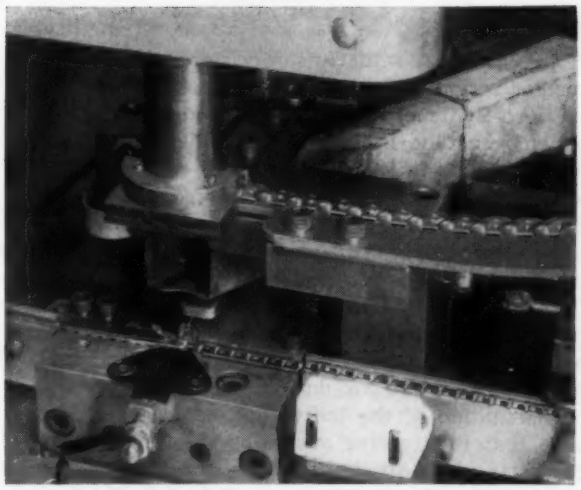
unusual slider

and the pull-tab are positioned against a positive stop in the assembly block. From the rear bowl, the bail feeds into the assembly block at 90° to the cam and pull-tab and enters slots in each of them. When the bail is seated it makes contact to complete an electrical circuit which actuates a solenoid plunger connected to a clamp in the front of the assembly block and locks the bail in position. The same electrical contact starts the drive-cam motor in the machine head.

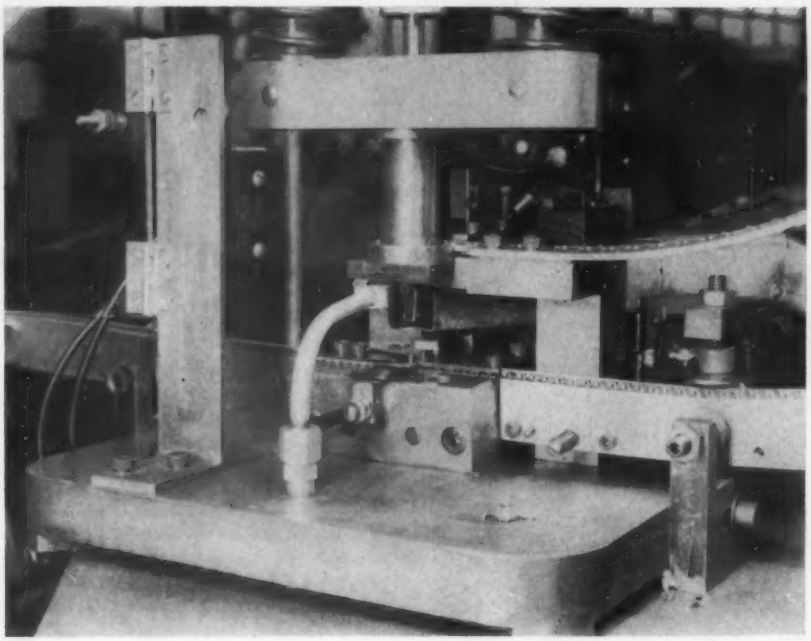
Driven downward by the cam in the machine head, the spring-loaded body mandrel presses the body, which has entered the assembly area from a bowl high at the right-rear part of the table, over the vertical arm of the bail. With the spring pressure of the mandrel still holding the assembled parts in position, the spinner descends to round the top of the bail; thus rivet the assembly and complete the slider.

As the spinner reaches the bottom of the stroke, it trips a MicroSwitch which releases the solenoid plunger and unlocks the assembly, which sticks, lightly, to the mandrel as it rises and is air-blown into a chute midway to the top of the stroke. The chute leads to a tote box. This completes one cycle. The next cycle starts when the next bail completes the electrical circuit.

Cam action provides rapid downward motion of the mandrel to the point of placing the body on the bail; then advance is slowed for the spinning operation. Spinning is completed as the mandrel reaches the extreme low position. At this point the bail vise is momentarily released by the solenoid to permit the now upward moving mandrel to remove the finished slider. In mid-position the mandrel momentarily slows to permit the air blast to blow the slider off the mandrel; then it approaches the stop-limit and reset-limit switches which are actuated by separate cams mounted on the mandrel camshaft. As the spring-returned mandrel comes to rest at the top



Assembly block . . .
. . . is built like a die, to die standards. Cam and tab feed from left and right; bail from rear. Action of mandrel prevents new bail from entering nest until previous assembly is clear and cam and tab are in position. Linkage at front of block is solenoid operated to tighten or loosen bail vise. Slider bodies feed into mandrel from upper rack; are mounted on bail during down stroke. Then spinner, with carbide head, drives through mandrel to spin bail and fasten assembly. MicroSwitch on door post shuts off all power when door is opened



Completed assembly . . .
. . . is lifted by mandrel on return stroke. Feed cam slows rise of mandrel as slider passes discharge chute. Compressed air from bent tube in base blows slider through chute into tote box. If machine is stopped by interruption of supply current while in the midst of performing a cycle, the cycle must then be completed by hand to restart it. However, the machine may be stopped in mid-cycle by opening the safety gate, or a switch in series with this circuit, and it will automatically proceed with the cycle upon closing the gate or the switch

of the stroke, it actuates safety switches to prevent further action if the mandrel is not fully returned.

Micro-Switches are arranged so that every component must be in place before the control panel will permit the next cycle to occur. A piece missing or out of position will shut off the machine and signal the operator.

To assure operator safety, the normal 110-volt power supply is reduced to 24 volts. Also, the operator's viewing door must be closed before the machine will function. Thus, adjustments, inspection of the tools, and cleaning can be done at the operator's will without any danger.

Orientation of the individual components, to assure that they arrive at the assembly area in the correct position, probably is the most difficult part of this setup. Before this phase of the brain-storming was finished, we made a lot of valuable discoveries —at least discoveries to us. Next to orientation, positioning the parts in the assembly block, holding the parts firmly in position, and joining the positioned parts are the most complicated operations.

SPINNING AVOIDS DISTORTION

Practically all of these problems are directly related to the shape of the individual component and its function in the completed assembly. Some minor changes in component design were made to simplify automatic orientation. Similarly, spinning was selected for heading the bail to fasten the completed assembly instead of riveting because it was less likely to distort the bail. It was impractical to support the bail arm within the body of the slider.

While specific characteristics may differ, designing a setup for automatic assembly requires somewhat the same considerations as a setup for manual assembly. For instance, you must have a key piece, a foundation component upon which all of the other components are built. We selected the bail as the logical key. The cam and pull-tab feed into position, the bail moves into these two pieces, then the body is inserted onto the bail, and the latter is headed. The bail also makes the contact that starts the cycle. Also, parts must be assembled or positioned so that they do not interfere with each other or with operation of the machine.

ORIENTATION BY CHARACTERISTICS

Preferred orientation is obtained as the part passes from the spiral track on the inside wall of the vibrating bowl to the guide chute. The principle is simply to select one characteristic that determines the proper position and use it to accept or reject the parts passing a given point. Rejected parts fall back into the bowl. Forward feed is faster than parts are assembled, thus the chute is always amply supplied.

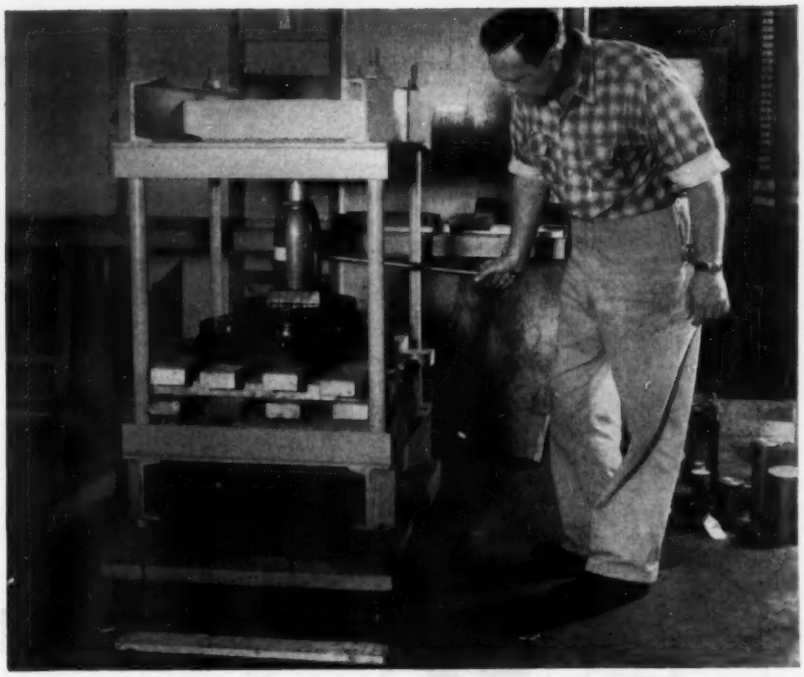
Cams, for instance, are tapered. Hence a rail is accurately located above one edge of the track. The thin edge of the cam passes under the rail, thus is permitted to enter the chute. In any other position, thicker portions of the cam strike the rail and the cam is knocked off the track into the bowl. The chute is given a half twist to deliver the cams to the assembly block thick edge up.

Bails are separated by the weight and position of the right-angle arm. A carefully shaped indentation in the track permits properly positioned parts to pass while the weight of the arm in the wrong position causes it to fall off the track. Simple, but effective. Tabs and bodies are sorted by similar arrangements. Projections or slots in the part are more suitable for locating than are holes. Of course, parts must be accurately made and free of burrs.

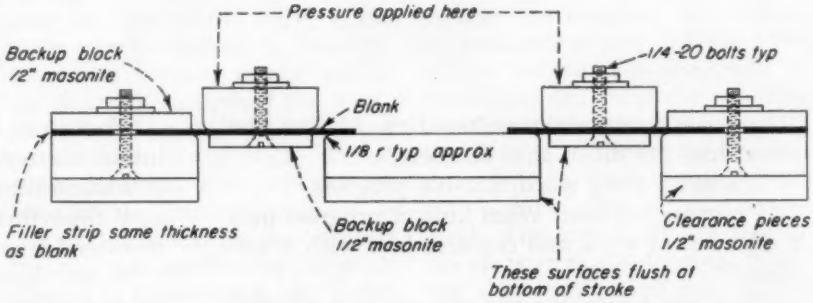
Homemade "press" and "dies" form limited-run parts

Our shops produce a variety of one-of-a-kind or limited-run parts for defense items. Some recent ones for aircraft or rockets involve circular flanged formers and frames with inside and/or outside flanges, usually of aluminum. They must be drawn to shape. To produce such parts, we have made our own press and dies, as shown here

RAYMOND R WIESE, president,
BRISTOL ENGRG CORP, BRISTOL, PENNA



PRESS is welded assembly of channel, angle iron, and plates, with base and head separated by pipe spacers over 1-in.-dia tie rods. The assembly is set on a 4-wheeled dolly so it can be put out of the way when not in use. A 20-ton hydraulic jack, operated by hand, provides the mechanism, and stroke is adjusted by building up a wooden or metal cribbing



SETUP could be used in a hydraulic press or in any other arrangement that will apply pressure to the parallel platens. 20 tons is adequate up to 0.064-in. aluminum. Any circular part that can be hand-formed can be made this way with practically no extra work on the die required to hand-form. Part quality approaches that achieved on production runs on metal dies. Here are suggestions:

Die thickness is determined by length of flange required, plus allowance for trim

Male-die dia is approximately 1/64 in. undersized for clearance

The desired angle of a flange is determined by the male die rather than the female. The female may be 90° in all cases

To produce a 90° flange, it is advisable to undercut the male die slightly as in hand forming

Backup plates are required. ½-in. Masonite is sufficient backing up to 0.064-in. aluminum

Backup plate is secured to die with flush bolts so die and blank are flush at bottom of stroke

Filler pieces of metal or Masonite may be inserted to bring unit flush top and bottom

Blanks must be polished on edge for inside flanges

Bolts holding backup block to die may be so spaced that they center blank on die

DIES are Masonite or similar material, bandsawed to shape. Here are typical dies and parts produced on them. Pressure buildup by the hand jack is so slow that the metal has plenty of time to flow, so no wrinkles are created, even on an inside flange. Operating sequence is:

1. Cut blank to size and polish inside edge
2. Place blank in die
3. Place backup plate over blank and bolt down
4. Place male die in center and drive through
5. Remove part and trim

Round Table

Automation Blues

"Don't talk to me about automation, Al. I've just about had my fill of that business."

"It's not a dirty word, Ed. It's progress."

"Progress, my foot! What kind of progress puts a man out of work and replaces him with a machine?"

"How can a machine put you out of work, Ed? If you can't be a foreman over men, you can at least be a toolmaker that builds the machines, or a maintenance-crew foreman."

"Yeah, but how about the worker who only knows how to run a press? What do you put him in charge of; wiping up the oil?"

"Why not upgrade him to a better job—something a machine can't do?"

"That's fine for a few lucky ones, but if you bring in machines, you can't possibly create enough new jobs to make up for the ones you destroy."

"That's rot, Ed. Ever since the Industrial Revolution started, people have been crying about this same thing. Yet there are more skilled jobs now than there ever were. All of industry has increased tremendously."

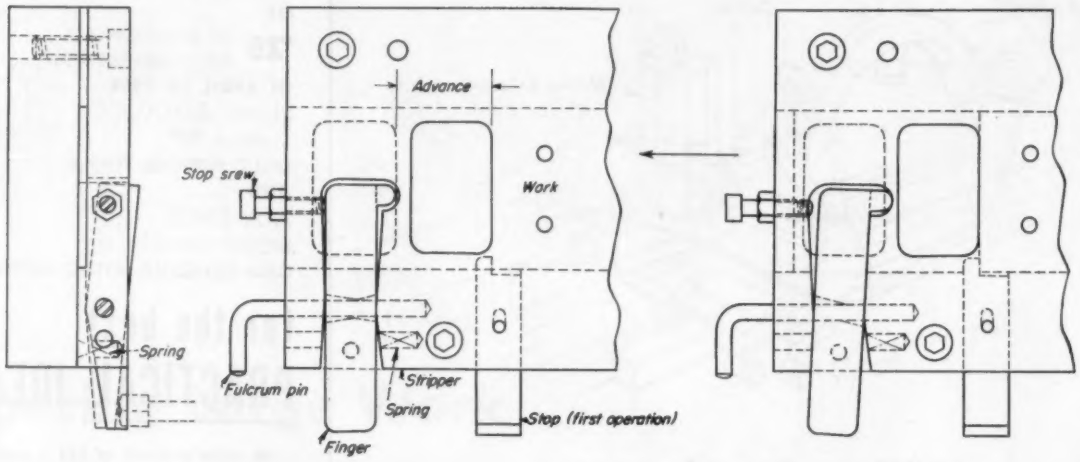
"It can't keep on expanding forever, Al. There's got to be a stopping place. Then you'll see all the men who've been replaced by machines—in the breadlines."

"There doesn't have to be a stopping place, Ed. That's like saying they'll never make anything to replace the horse. They'll never stop inventing new machines, and every time they do, they'll have to get toolmakers to build them and top maintenance men to keep 'em going. You can't do away with the need for human skill and craftsmanship."

"Well, it sure looks to me like they're trying their damndest!"

Can we ever get to the point where human work won't be required? Is automation a step forward putting everyone out of work, or does it create new work? Your ideas on the subject will interest others. Discussions of earlier topics start on page 176.

Practical Ideas . . .

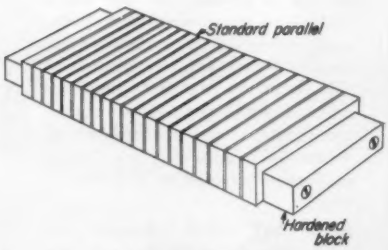


Simple Progressive-Die Stop

We have found the device shown to be a simple, easily made, practical work stop for progressive-die work. The basic part is a swivelling finger which is held in place until displaced by a stud attached to the side of the punch holder.

The finger is attached to the stripper with a fulcrum pin. In the punch holder is a setscrew which, as the punch descends, hits the outer end of the finger, causing the finger to turn on the fulcrum pin. The setscrew on the punch holder is adjusted so it just lifts the stop clear of the work. The horizontal spring pushes the finger to ride over the edge of the work, so the stock can be moved to the left. Then the vertical spring pushes the finger down against the work, so it drops in the next opening punched out of the stock. As the stock is further advanced, the far edge of the punched opening in the work pushes the stop against the stop pin, positioning the work correctly. If pilots are used in the punch, to pick up the work location, a few thousandths of overtravel can be introduced, by adjusting the stop pin to suit.

Other advantages are: the springs are confined, and cannot be damaged or lost, and are positive in action. The stock-end of the finger can be made any size and shape, to conform to the work. The hole in the finger for the fulcrum pin is taper-reamed from both ends, to allow for side movement. The opening in the side of the stripper is also tapered, to allow side travel. The stop at the right of the stripper is a first-operation stop, for the piercing step. *George F Oliver, Warren, NY*



Improved Magnetic Parallels For Grinding Small Work

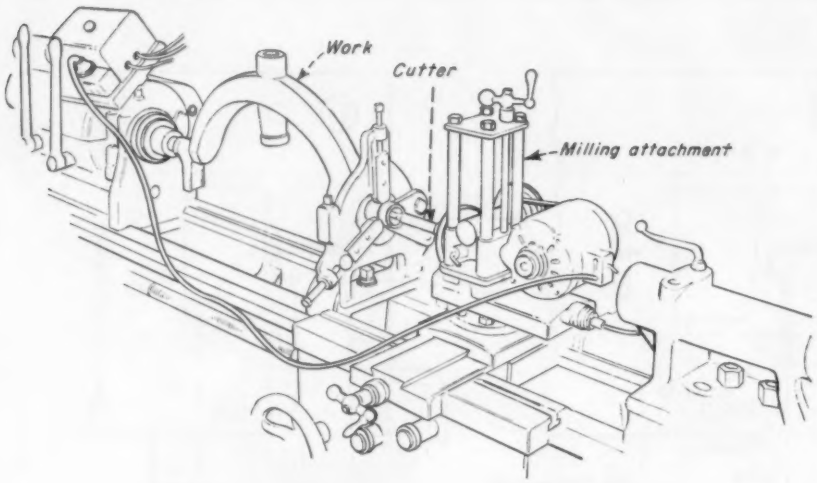
When small pieces are to be ground to close tolerances, the common practice is to put the work on parallels, which can be ground in place, and the entire surface of the chuck need not be reground.

One of the problems of this system is that when the chuck is turned off, the hardened work will often stick to the parallels more firmly than the parallels stick to the table, so the setup is disturbed when removing the work.

To avoid this, we have attached a steel block to each end of the parallel, flush with one face. It will be found that the residual magnetism in the hardened blocks will hold the parallels in place, and the work can be lifted without disturbing the parallels. *Raymond L Levy, Westerly, R I*

Hole Aids Pattern-Making

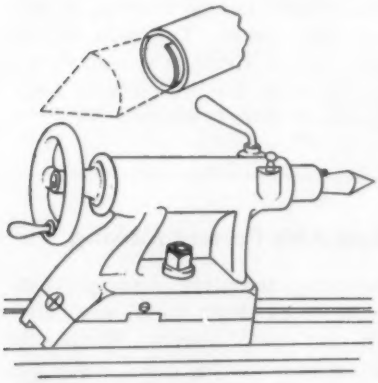
Samples, templets, and patterns made from sheet metal are often cut out with shears. When the workpiece contour has a sharp recess or corner, it is hard to get a clearly finished radius with the shears. To avoid this trouble, after the pattern is laid out on the sheet metal, we drill a small hole at the corner of the pattern, so that the radius of the hole falls along the layout line. The hole prevents the shears from distorting the corner and produces the radius desired. *Federico Strasser, Santiago, Chile*



Toolpost Milling Attachment Bores Large Work

Boring work that is too large to swing in the lathe is easily accomplished with a toolpost milling attachment as shown here. One end of the work is held stationary in the chuck of the lathe, while the other end is centered and held rigidly in position in a conventional steady-rest.

The attachment is simply fastened in the compound rest of the lathe, and is easily aligned. To do larger work than is shown, we remove the tailstock and fasten the work on the end of the lathe. The milling attachment is then used to bore into the work. *Linden J Richards, Harvard, Ill*



Shims Offset Tailstock To Turn Small Taper

We have occasionally needed an arbor or mandrel on which to turn just a few pieces, and would just turn a piece of bar stock on the toolroom lathe. Because the total taper of the work is usually small —0.003 or 0.004 in., and the taper attachment is not too useful on such a small taper, we had to offset the tailstock. We try to keep the toolroom lathe accurately aligned at all times, so the turning of the mandrel took quite a bit of time, including resetting the lathe tailstock.

We have successfully avoided this step by inserting shims along one side of the center when inserting the center in the tailstock. The required thickness of the shim can be found by touching the tool to both ends of the arbor and reading the taper directly off the crossfeed dial. If greater accuracy is needed, a straight bar can be placed between centers, and the taper found by indicating the bar.

The shim should be about three quarters of the diameter of the center, to give 3-point contact and help keep correct vertical alignment. *Anthony J Rada, Ravenna, Ohio*

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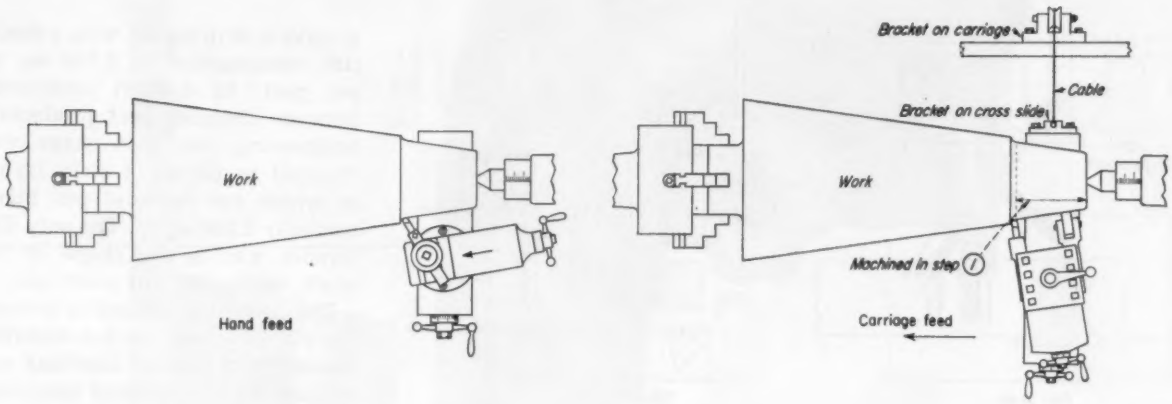


Tapering Large Work

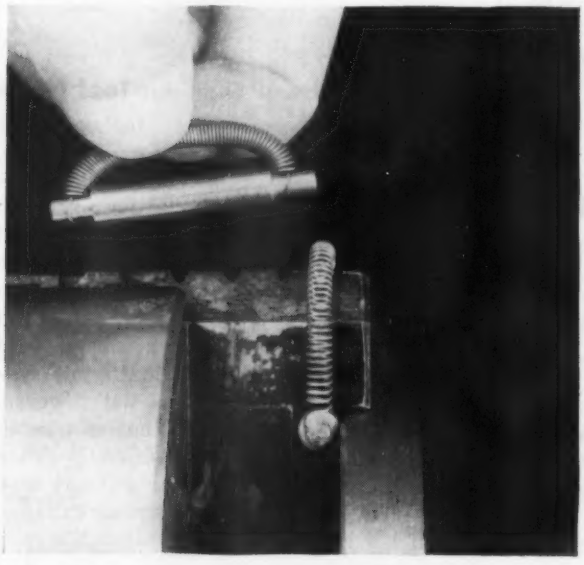
I was interested in the ingenious taper attachment by Manohar Lal (*AM*—Dec 6, '54, p176), which turned work which was too steeply tapered to suit the taper attachment on the lathe. We have encountered the same problem, but have solved it somewhat differently.

The partially machined casting was chucked on one end and supported by the tailstock center at the other end. The compound was set at the proper angle of taper, and a cut was taken on the tail-center end of the work, by hand-feeding the compound. This cut was taken deep enough to clean up completely throughout the length of travel of the compound.

Then a square turret was mounted on the compound and a cutting tool was put in the left-hand side of the toolholder. A hardened and ground steel roller, mounted in a special holding shank, was placed in the right-hand opening of the square turret. The feed nut was disconnected from the crossfeed screw and the taper attachment was removed from the lathe. A bracket, supporting a small grooved pulley, was bolted onto the back of the carriage in place of the taper attachment.

A length of steel aircraft cable was fastened to the end of the cross slide and over the pulley, and a weight was supported on the end of the cable. The cutting tool was adjusted so it just contacted the work, and toolholder and roller holder were locked in position.

When the lathe was started and the carriage feed engaged, the direction of travel of the tool was controlled by the riding of the steel roller on the previously machined part of the taper. The first surface machined, using the compound feed, must clean up entirely around the work, as this surface is used as a guide. *H J Gerber, Stillwater, Okla*

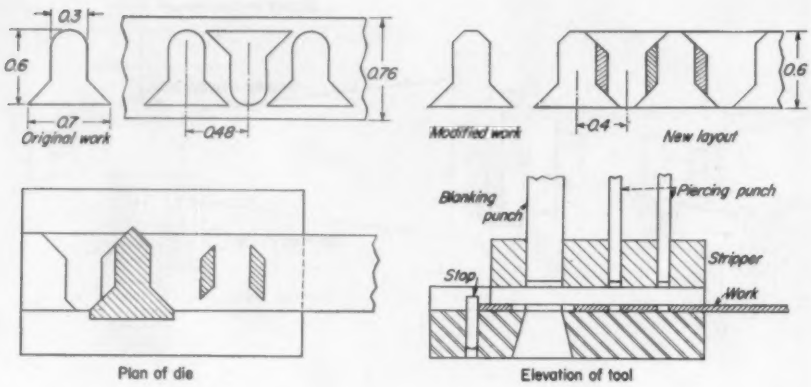


Packing Spaces Thin Work

In maintenance work, we often have to reduce the width of metal disks by facing them in an engine lathe. The steps on the chuck jaw are usually wider than the disk, so some method has to be found to make sure that the sides of the disk are parallel, without always facing the jaws off until the step is sufficiently narrow.

To do this, we have made a number of small spring-held spacers which we use as packing on the jaws, as shown here. The packings are short pieces of drill rod, reduced on either end, to hold the spring in place. When these packings are clipped onto the jaws behind the work, the work can be loaded and unloaded easily without danger of the rods falling out of place. *C T Bower, London, England*

Ed note: It would probably be a good idea to color the necked-down ends, with one color for each different size of drill rod, so pieces of rod of different size won't accidentally be put into the same setup.

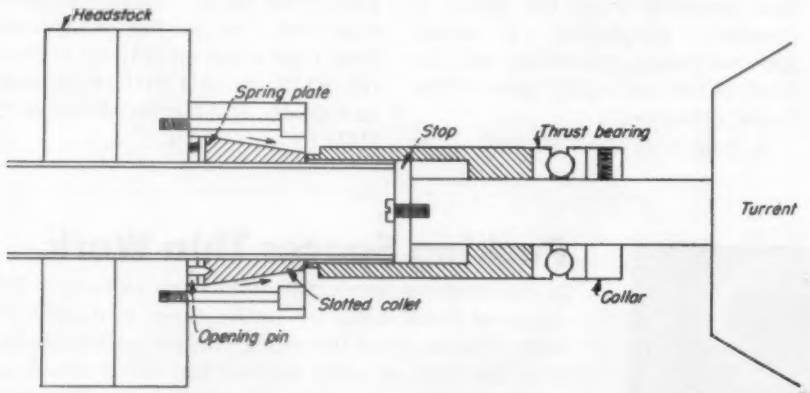


Modified Part Design Saves Stock

One of the aims of a tool engineer is economy of tooling and production. This end can easily be gained by a little ingenuity and cooperation between tool engineer and part designer. In fact, in many cases, some slight change in shape and/or dimensions of a part may permit adoption of fundamentally different die design, with consequent important savings in material, time, and labor.

One such case occurred in our shop. The first part design was as shown at left in the illustration. The corresponding die would have to have a strip layout with a material consumption of 0.365 sq in. per part. In a short conference between designer and production engineering, the part shape was changed to permit a strip layout in which the material per blank was only 0.240 sq in. The only difference was in the shape of the work, saving 34% of material.

The economy realized in making the die was even more noticeable. Instead of a regular blanking operation, we have a cutoff operation, combined with internal trimming, which greatly simplified the building of the die. We are also making considerable savings in production and labor costs. Instead of passing the strip through the die twice—once in each direction, to blank out alternate rows of parts, with the modified die we cut every other blank. The intermediate ones remain on the die plate and are ejected by an air blast. *F Strasser, Santiago, Chile*

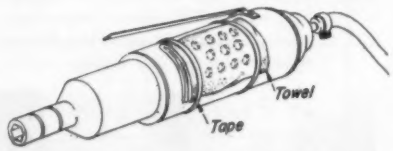


Shop-Made Collet Holds Thin Tubing

We recently had the job of cutting off short lengths of 1¼-in. thin-walled aluminum tubing. Our maximum collet capacity is only 1 in., so we used this method:

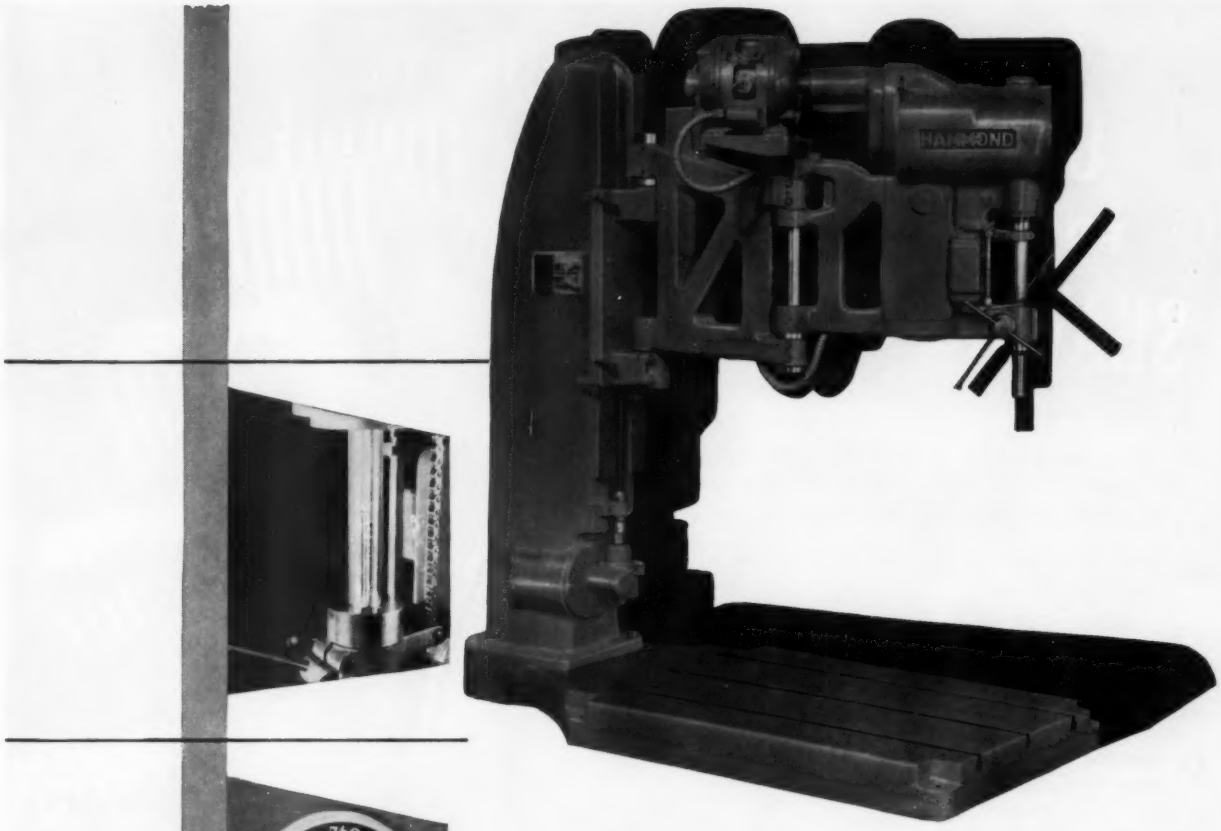
The hole in the spindle of the turret lathe is 1 5/16 in., so it could accommodate the tubing. We built a spring-loaded slotted collet, as shown, which held the work. To open the collet, we made a turret stop which slid over the tubing and butted against the face of the collet. Pressure against the springs opened the collet, allowing the tubing, which had a constant pressure applied at the end in the bar stock guide, to move forward against the work-stop. Opening and closing action was held to 1/32 in. by a tapered pin.

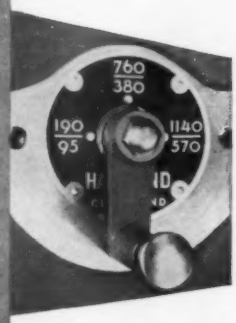
With a set of 3 staggered cutoff tools on the cross-slide, production of burr-free rings was quite rapid, because the work could be advanced without stopping the machine. *John Maher, Austin, Texas*

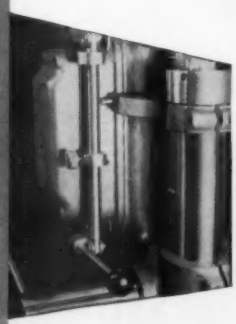


Dishtowel Cuts Air-Tool Noise

We have several air tools, such as drills, screwdrivers, and the like, which are rather noisy when running. To try to cut the noise, we wrapped about 4 thicknesses of heavy dishtowelling around the exhaust of the tool. This cut the noise by about 75%, but, even when the rags were soaked with the lubricating oil in the air system, the speed was not lowered. We used surgical adhesive tape to hold the cloth in position, but care must be taken not to put any tape over the opening of the air exhaust. *J H Sperman, Brooklyn, NY*







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Hammond Radial Drilling and Tapping Machines may be spotted in the production line for drilling, tapping or reaming. With its unique Bracket Type construction the spindle can be swung quickly from hole to hole. Six Quick Speed Changes are instantly available and the Hammond Tapping Reverse is very fast and convenient to operate.

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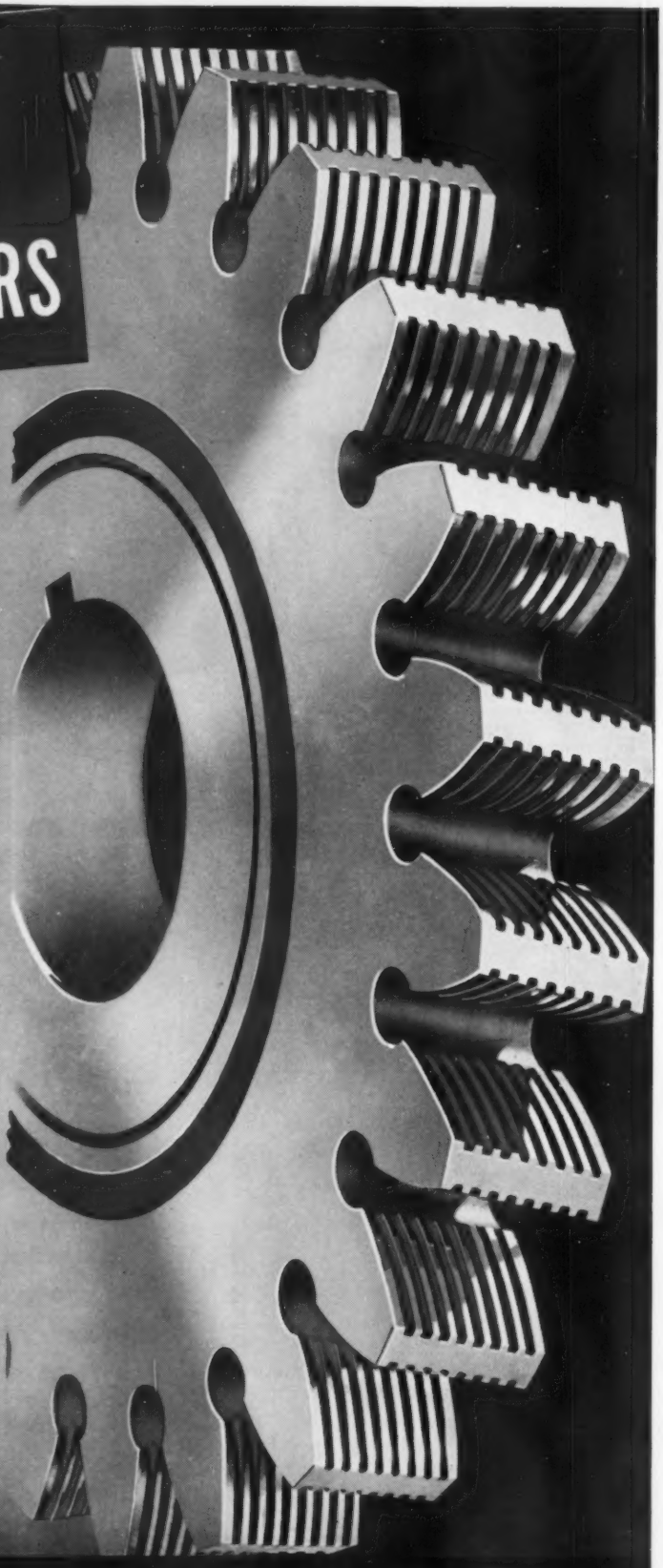
FOOTBURT

MACHINE TOOLS

CHECK LIST FOR BUYERS OF SHAVING CUTTERS



Knowing the absolute necessity for QUALITY in your gear shaving cutters, you might consider these points the next time you order.

1. **How much experience does the cutter manufacturer have?**

   Since 1932 when National Broach built the first Rotary Gear Shaving Machine, this company has always been the largest producer of shaving cutters.

2. **Has the cutter manufacturer a staff of engineer specialists who concentrate exclusively on cutter design?**

   National Broach has such a staff.

3. **Does the cutter manufacturer heat treat his own tools and is his grinding department temperature controlled?**

   Every Red Ring Cutter is heat treated and controlled by Red Ring metallurgists and ground on special Red Ring grinders under precise temperature control.

4. **Does the cutter manufacturer prove every cutter design by actual try-out in his own plant before it is released?**

   No new Red Ring cutter design is ever released otherwise.

5. **Is the cutter manufacturer prepared to assist you in cutter development — involute modification, etc. when needed?**

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For further information, write for Chapter 2, Modern Methods of Gear Manufacture.

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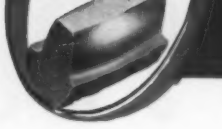

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WORLD'S LARGEST PRODUCER OF GEAR SHAVING EQUIPMENT

PROPELLER-AGITATED QUENCHING...I

Source: "Improved Quenching of Steel by Propeller Agitation", published by the United States Steel Corp, and abstracted by permission.

Usefulness of steel as a structural material is due in large part to the fact that it may be adapted to a wide range of mechanical property requirements by proper heat treatment.

It has been well established that the ultimate combinations of strength and ductility in a given steel are achieved by heat treatments that yield a homogeneous microstructure. One of the most effective means of accomplishing this end is by first quenching to a fully hardened structure and then tempering to obtain the desired hardness and ductility.

One major development, which has helped to accomplish this purpose and which has had widespread use, is the propeller agitation of quench baths. Heat-extracting power of quench baths can be increased greatly by properly engineered propeller agitation.

EFFECTIVENESS OF QUENCHING PRACTICES

The rate of heat extraction in quenching varies widely, depending upon mass of the part, surface area available for heat transfer, type of quenching medium, and degree of circulation or agitation of the medium. Table I shows a comparison of the heat-extracting power of various quenching media under different conditions of agitation.

Most oil quenching installations, in which the quenchant is led off to be cooled and then returned, have mild directional circulation and an H (severity of quench) value of about 0.35. Still stronger circulation, which will produce H values up to 0.50, can be obtained by pumps.

Severity of quench of 0.80 to 1.1 in oil is obtainable with violent agitation such as is provided by propellers, submerged jets, or high-capacity pumps. Unless the turbulence is uniform around the part, non-uniform heat extraction will result with consequent danger of distortion, cracking, and soft spots. The uniform agitation resulting from properly placed propellers assures not only good heat extraction (high severity of quench), but also uniform heat extraction.

Propeller-type mixers are designed to pump large volumes of liquid at low heads. As a rule of thumb, a propeller mixer will pump about ten times as much as a centrifugal pump with the same horsepower.

MECHANISM OF HEAT TRANSFER

When quenching without agitation of the bath or the steel, the rate of cooling inside a piece is determined chiefly by the surface-

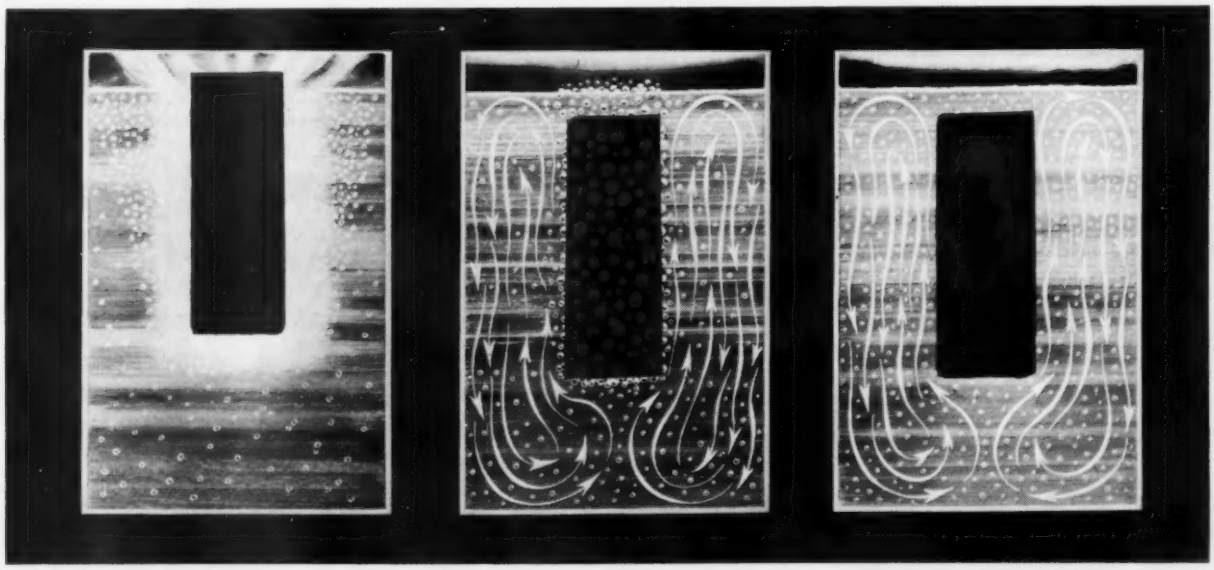
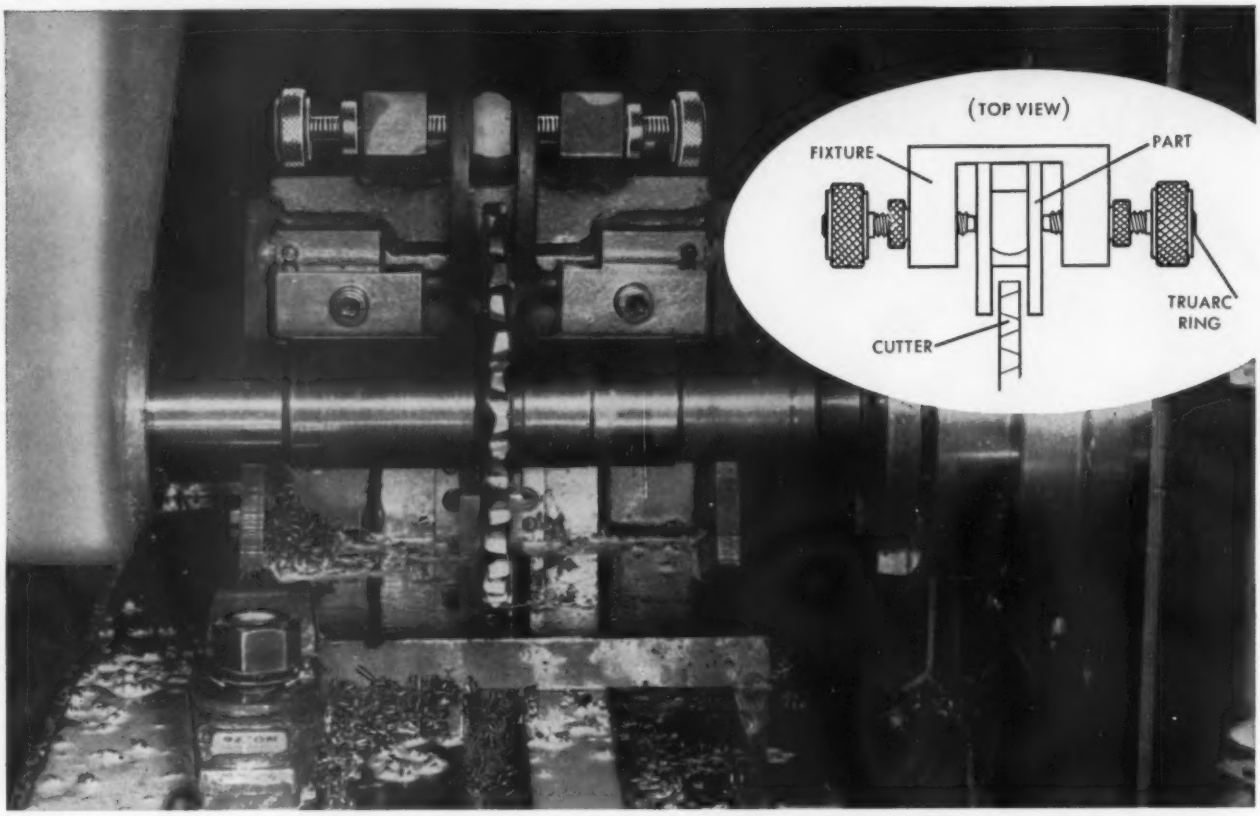


FIG 1 FIG 2 FIG 3



...at North American Aviation, Inc., Los Angeles Division:

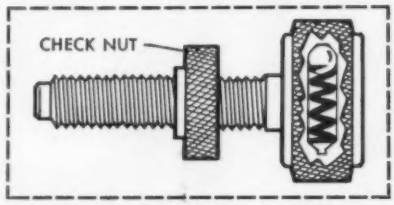
Vlier Torque Thumb Screws eliminate guesswork when supporting parts against drill or mill thrust

Prevent inaccurate machining which always occurs when work is not properly supported...

Vlier Torque Thumb Screws are simple, precision tools. They provide an accurate means of holding or supporting a part with a predetermined amount of end pressure. When used beneath or behind cutters as a positive support, they eliminate chatter, vibration and prevent deflection of the part which would result in loss of size. *Even fragile, thin-walled parts can be held securely against machining pressures without distortion.*

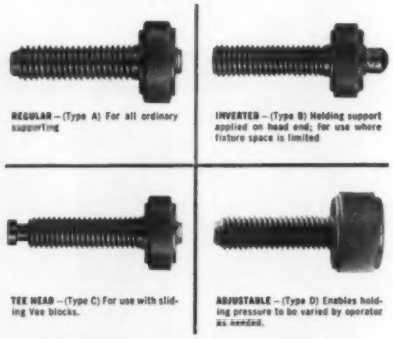
Impossible to overtighten... The head of the Vlier Torque Thumb Screw is designed with an *accurate,* spring-controlled ball-check which functions *automatically.* When the predetermined supporting pressure is reached, the head rotates freely, *preventing overtightening of the screw.* Spring pressures are determined at the factory and accuracy is guaranteed for the life of the tool. A knurled lock-nut prevents loosening of the screw due to chatter or vibration. Backing off action is positive at all times.

Built to last a lifetime... Design of Vlier Torque Thumb Screws is extremely simple. There is nothing to wear out; nothing to jam; nothing to get out of adjustment. By removing a Truarc ring the head can be taken apart for cleaning. Cover plates protect moving parts from dust, chips, etc., assuring years of profitable use. Order a supply of these money-savers from your Vlier distributor today.



In the Vlier Torque Thumb Screw spring pressure is applied perpendicular to screw axis, eliminating inaccuracies due to wobble or "slop" as wear occurs.

Available in four types; 19 models


REGULAR – (Type A) For all ordinary supporting
INVERTED – (Type B) Holding support applied on head end; for use where fixture space is limited
TEE HEAD – (Type C) For use with sliding Vee blocks.
ADJUSTABLE – (Type D) Enables holding pressure to be varied by operator as needed.

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PROPELLER-AGITATED QUENCHING...II

cooling rate. This is characterized by three distinct stages.

In the first stage, Fig 1, the part is at a high temperature. The liquid in immediate contact vaporizes and surrounds the part with an insulating vapor film. Therefore, cooling in this stage is relatively slow.

The second stage, Fig 2, begins when the liquid breaks through the vapor film and makes contact with the part and boils. Heat transfer during this stage is rapid because fresh, cool liquid continually replaces the insulating vapor film that tends to form at the surface of the part.

The third stage, Fig 3, begins when the rate of coolant flow is such that the liquid does not reach its boiling point while passing over the work, even though the surface temperature of the work is higher than the boiling point of the liquid. Boiling ceases and the entire surface of the part is in intimate contact with the liquid. Cooling of the part then takes place by conduction and convection.

The temperature of transition from the slow first to the rapid second cooling stage in the quench can be raised, and the time required to enter the second stage can be shortened appreciably either by motion of the part quenched or by agitation of the media. Advantage is taken of this fact, for instance, in the quenching of relatively small parts, when few in number, by imparting a figure-eight motion by hand to the part in the quench bath.

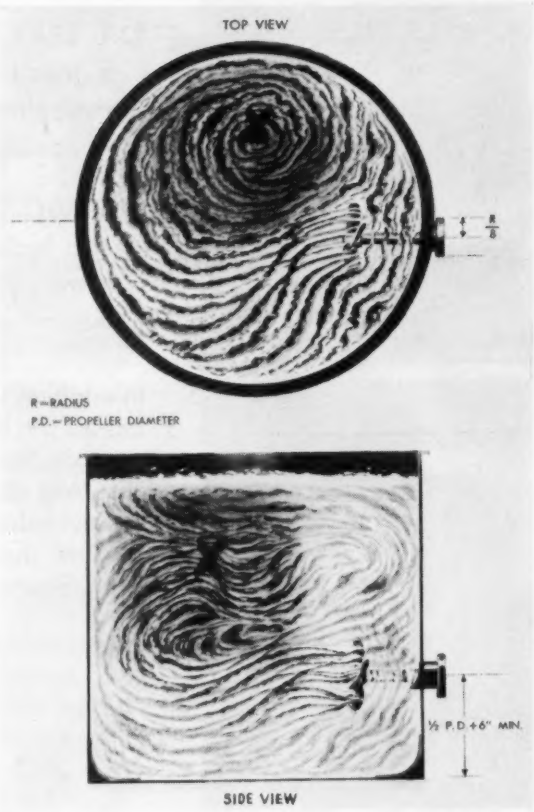

FIG 4 ... X marks the spot where the work should be placed. This region of uniform turbulence is at least 8 in. below the top of the liquid and about midway from centerline to edge of tank

table 1 . . SEVERITY OF VARIOUS QUENCHES*

	AIR	OIL	WATER	BRINE
No circulation of fluid or agitation of piece	0.02	0.25-0.30	0.9-1.0	2
Mild circulation (or agitation)		0.30-0.35	1.0-1.1	2-2.2
Moderate circulation		0.35-0.40	1.2-1.3	
Good circulation		0.4-0.5	1.4-1.5	
Strong circulation	0.05	0.5-0.8	1.6-2.0	
Violent circulation		0.8-1.1	4	5

**After Grossman ("Elements of Hardenability") ASM, Cleveland, 1952*

With large work it is necessary to force the quenching medium surrounding the part into a continuously turbulent motion. Proper agitation causes fresh volumes of the medium to flow against the surface of the part with enough force and velocity to hasten the

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PROPELLER-AGITATED QUENCHING...III

breakdown of the vapor film. The stronger the turbulence, the quicker will be the impingement of the coolant on the part. By shortening the first stage and thus lengthening the more efficient second stage, faster heat extraction is assured. Another advantage is that sludge formation in the oil is greatly reduced.

TURBULENCE BY PROPELLERS

When a propeller rotates in a liquid, the liquid moves away from all the thrusting surfaces of the blades in a helical motion with a rotary component in the same direction as the blade rotation. The discharge stream sweeps across the tank bottom, gradually expanding in width until it is deflected upwards and to the right by the opposite tank wall. The flow circuit is completed as the quenchant feeds across the liquid surface and downwards to the propeller.

After the propeller has been operating a few minutes, three general motions of the liquid may be observed. There is a general swirl motion and a general top to bottom motion. Where there is a meeting and mixing of these motions, there are a multitude of eddy currents which create uniform turbulence. This region of uniform turbulence, Fig 4, is indicated by an X where the work should be placed during quenching. It is obvious that the part being quenched should not be directly in front of the propeller.

In planning new quenching facilities, the size and shape of the largest quench load to be handled will govern the size and shape of tank. Thus, suitable agitating units can be installed at the beginning with a minimum of extra work. Existing quench tanks can usually be adapted for propeller agitation, often with only minor alterations such as the installation of baffling. However, it is sometimes necessary to change tank dimensions to permit optimum conditions for propeller agitation.

(To be continued)

table 2 . . POWER REQUIREMENTS FOR PROPELLER AGITATION

TANK VOLUME, GAL	STANDARD QUENCHING OIL	WATER OR BRINE
50 to 800	0.005 hp per gal	0.004 hp per gal
800 to 2000	0.006 hp per gal	0.004 hp per gal
2000 to 3000	0.006 hp per gal	0.005 hp per gal
Over 3000	0.007 hp per gal	0.005 hp per gal

table 3 . . RATINGS OF 3-BLADED MARINE-PITCH PROPELLERS OPERATING AT 420 RPM

PORTABLE UNITS—TOP ENTERING		SIDE-ENTERING UNITS	
HP	Propeller Dia, In.	HP	Propeller Dia, In.
¼	8	1	12
1/3	10	2	14
½	11	3	16
¾	12	5	18
1	13	7½	20
1½	14	10	22
2	15	15	24
3	16	20	26 (25" in water or brine)
		25	28 (26" in water or brine)

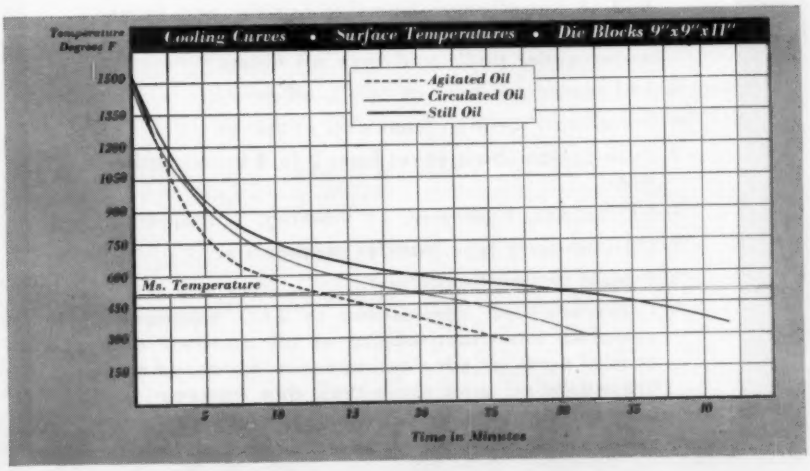
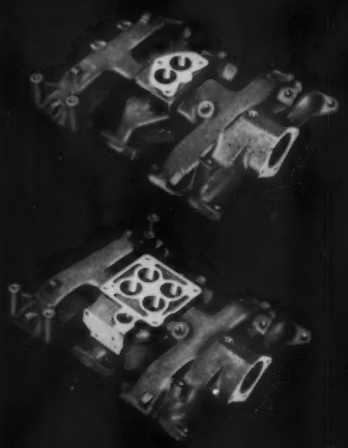


FIG 5

Another Transfer-matic by Cross

Mills, Drills, Bores, Taps, 2 and 4 Barrel Intake Manifolds

- ★ Rough and finish mills carburetor pad; mills choke pad (4 barrel only); bores carburetor port holes; drills and chamfers all holes (except 3 holes in water outlet pad); and taps all holes.
- ★ 140 pieces per hour at 100% efficiency.
- ★ Initial part location from port openings.
- ★ Push-button changeover from 2 to 4 barrel carburetor.
- ★ 13 stations; 1 loading, 11 working, 1 unloading.
- ★ Lift-and-carry type transfer mechanism.
- ★ Pre-set tooling throughout.
- ★ Other features: construction to J.I.C. standards; complete interchangeability of all standard and special parts for easy maintenance; hardened and ground ways; drag chain type chip conveyor.



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Talking Shop . . .

THE MIDDLE MAN

THE AVERAGE AMERICAN "middle management" business executive receives a salary of $11,200 a year, according to the American Management Association's fourth annual survey of middle-management compensation. The new survey covered more than 100 American companies last year and 3,200 executives in "middle management" (those between the policy-making level and that of general foreman or supervisor). Typical of positions studied are those of district sales manager, plant manager, chief cost accountant, office manager, labor relatons manager, divisional purchasing agent, and chief project engineer.

Other characteristics, as indicated by the survey, include: Annual salary is between $7,000 and $14,900. Little practical difference from geographical location. Salaries do vary with responsibility and among departments; for example the average annual compensation of regional and district sales managers is $12,000, compared to $14,000 for factory managers and factory superintendents. Only 36% received bonuses last year; even fewer were eligible for stock purchase plans. However, the man probably is covered by company pension, group life, and group hospitalization programs. For the most part, he receives no additional compensation when he works overtime. He is 45 years old and has been in his present job for four years (70% have been in present positions less than seven years).

HIDDEN DANGERS

ON A RECENT VISIT to a large manufacturing company, we heard an unusual problem. One product required some particularly tricky welding, and the inert-gas-shielded-arc technique was used. About 20 ft away, a trichlorethylene degreaser was installed to prepare the work for welding. Shortly thereafter the welder began to complain of headaches and nausea.

None of the local people could think of the cause, although you can be sure that theories ran wild, so they called in the company chemist. He soon discovered that small quantities of vapor from the degreaser, being very heavy, were rolling across the intervening floor space and into the weld zone, where they were converted to minute quantities of phosgene gas by the molten metal. Of course, the welder working directly over the zone inhaled the gas. A baffle, 3-ft high, placed between the two pieces of equipment, prevented vapors from reaching the welding area and solved the problem. The welder is fine.

CHEST HELP

KOLLSMAN INSTRUMENT CORP, Elmhurst, NY, has taken an active part in the local Community Chest campaign, 90% of its 3450 employees contributing $50,000 this year. Union and company officials cooperated on the job, aided by the company house organ, public-address appeals, and personal contact with every worker by a volunteer team.

THOUGHTS FOR TODAY

ANYTHING WORTH DOING is worth doing for money.

ONE GOOD TEST is worth a thousand expert opinions.

A FRIEND PASSES

DAN FRANKFORTER, 40, chief of the Fairchild Aircraft Division's photo crew, passed away suddenly at his home in Waynesboro, Penna, on May 29. Long recognized as one of the nation's top photographers in the aircraft industry, Dan traveled world-wide to record its life and growth. He and his crew have cooperated many times in the preparation of articles for AMERICAN MACHINIST. We shall miss his talent for telling a picture story. Many of his photographs will instruct the builders of tomorrow.

TIME ON OUR HANDS

NEARLY HALF the population of the US is now on daylight-saving time, but the idea is far from universal. In fact, only the New England states, New York, Pennsylvania, Maryland, Delaware, New Jersey, Indiana, Illinois, California, and Nevada have it. Some scattered cities have adopted it in Ohio, West Virginia, and Kentucky; one city in Virginia, one in Missouri, one in New Mexico, one in Washington, and two in Montana. On the other hand, eight cities in Illinois prefer to remain on standard time. What's more, there are wide variations in date of shifting from and to standard time.

States rights and local options are all very well, but this seems to be carrying things a bit far. First thing you know, we'll be having individual plants, or even individual employees, doing their own opting.

News of Metalworking . . .

AFTER GAW—WHAT? They're Calling It

GAW will start to make itself felt throughout U S industry shortly. For one thing, industrial prices are already on the upswing. For another, auto suppliers are scared the automakers will pull parts manufacture back into their plants to keep annual output evened out. And, as a result of GAW, you can look for a new era in collective bargaining in almost every industry

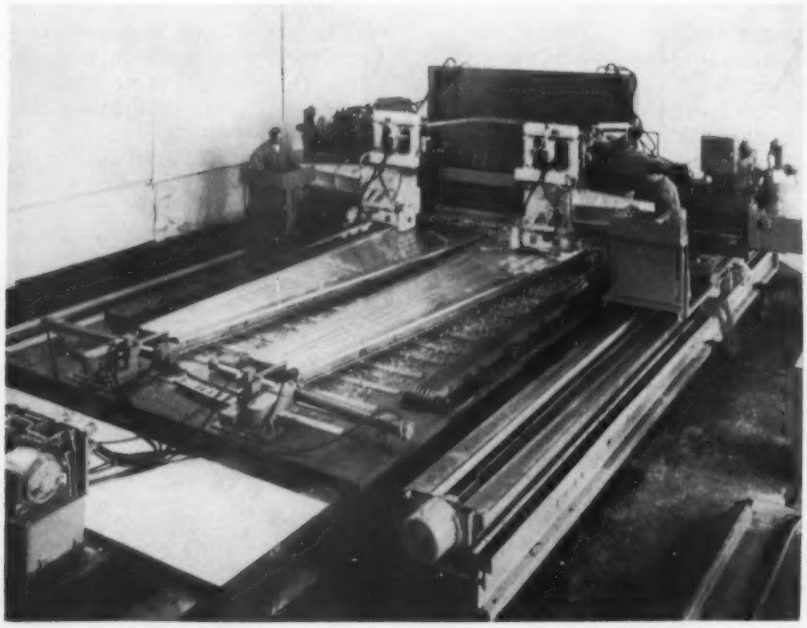
NEW YORK—What will the effects of the guaranteed annual wage be on U S industry as a whole? McGraw-Hill's Department of Economics has come up with a speculative analysis, based on the Ford-created and GM-okayed agreement with UAW-CIO.

The Ford contract isn't quite what UAW-CIO wants in several important respects, mainly in that it limits layoff payments to 26 weeks instead of the one-year maximum sought by the union. But it does represent a concession by Ford and GM of an obligation to provide income to employees when they're not working. That is the wedge driven into the heart of autodom's labor-management policies. And UAW and other unions can be expected to do everything in their power to widen the scope of future collective bargaining.

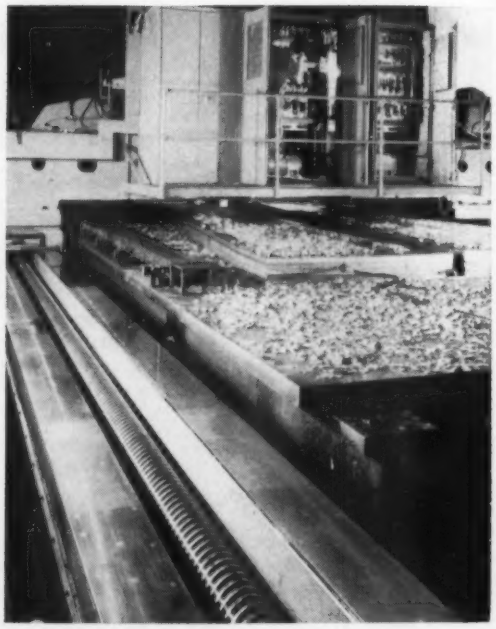
A comparison of what UAW asked and what UAW will get under the Ford agreement, will give you an idea of which areas to watch in future bargaining—for UAW will assuredly seek to achieve its original demands in future bargaining sessions with Ford, GM, and the other automakers. These are the critical areas:

- **Duration of payments:** UAW wanted a 52-week maximum; got 26 weeks.
- **Size of payments:** UAW wanted enough money to enable workers to maintain living standards. Ford and GM agreed to only 65% of after-tax earnings as a maximum.
- **Eligibility:** UAW proposed layoff payment eligibility after three months' service. Ford and GM agreed to one year's minimum.
- **Financing:** UAW proposed that layoff payments be a current obligation of the employer—with the fund being a reserve for hard times. In the Ford-GM agreement, all payments come from the trust funds.

From 13-Year-Old Pit Planer



Simultaneous machining . . .
TWO ALUMINUM ALLOY SLABS ARE MACHINED SIMULTANEOUSLY on this 30-ft, 225-ton skin mill converted from a 13-year-old pit planer. Carbide cutters remove up to 250 cu in. of metal per min. Special chute carries away chips



60 individual controls . . .
THESE CABINETS ENCLOSE 60 individual controls, making machining of skins entirely automatic

the "Guaranteed Annual Wedge" Now

● **Guaranteed workweek:** UAW proposed that any worker called to work any week be given 40 hours' work or equivalent pay. The Ford-GM agreement merelv continues former provision of four hours' call-in pay for any day an employee is scheduled to work—although Walter Reuther has indicated the GAW fund will be used for short workweek payments.

● **Reinsurance:** UAW suggested "reinsurance" of individual company reserve funds to reduce the size necessary to meet obligations under the UAW plan, but evidently considered this a long-range proposition for smaller employers, and didn't embody this provision in the Ford-GM agreements.

GAW — a Misnomer

While it is common practice to refer to the Ford-GM-UAW agreement as the guaranteed annual wage, this is a misnomer. The agreement does not guarantee a worker that he will make, say, $5000 a year, whether he works full time or not. It is actually a liberal form of unemployment compensation in which the employer makes up the difference between state unemployment compensation and a maximum of 65% of the worker's after-taxes salary to a limit of $25. This means that sooner or later UAW will resume its gunning for a real guaranteed annual wage. And it is in the interest of the union and the automakers to urge higher state unemployment benefits.

The Implications

What are the implications of the Ford-GM-UAW plan for U S industry and the U S economy?

● Under the agreement, taking Ford as an example, the layoff benefit program will cost the company 5¢ per manhour worked—the amount of company payments into the trust funds. This is also the limit of Ford's liability under the contract, regardless of the volume of layoffs or the state of the trust funds. This 5¢ per manhour, along with an estimated 15¢ in other benefits provided in the contract, will be absorbed into Ford's production costs, and will exercise a rise in auto prices. This will reinforce an already evident trend toward industrial price rises —one that will ultimately be reflected in all lines of goods.

● If Ford, GM and other automakers who agree to similar programs, decide to exploit every chance to stabilize production and employment schedules, independent suppliers will have tough going. One way to even out annual production is for the automaker to make more of his own parts during the slack season. If the major automakers resort to this practice wholesale, specialized parts makers could be driven out of business.

(Continued on next page)

450,000-Lb Skin Mill Is Converted

Traveling operator pulpits ...
OPERATORS RIDE IN PULPITS MOUNTED ON TRAVELING RAILS, each has consoles with banks of pushbuttons hooked in with the 12-ft high, 25-ft-wide, 30-ft-long machine's 60 individual controls

ALBANY, NY — One of the biggest machine tool conversions in industry history — a 450,000-lb skin mill built around a 13-year-old pit planer — has been shipped by Simmons Machine Tool Corp to North American Aviation, Los Angeles, where it will sculpture one-piece wings for the F-100 Super-Sabre Jet — two at a time. The skin mill can also be tooled to machine up to five leading-edge skins on five separate vacuum chucks. The skin mill, which has completed operations that formerly required 60 hr in 3 hr, 15 min, has longitudinal cutting speeds ranging from 20 to 150 ipm in both directions. Transverse cutting feeds vary from 5-62 ipm, and diagonal cutting is provided. Cutter heads are tracer controlled, and cross-slide indexing provides visual inspection and automatic location of cutting tools. Dimensions are held to plus or minus 0.001 in. Before shipment of the skin mill, North American engineers spent two weeks at Simmons putting the machine through exhaustive tests.

GAW continued

● What about Chrysler and the "Little Three"? Walter Reuther has indicated that UAW regards the Ford settlement as a pattern for the rest of the auto industry. The immediate difficulty of the independents, if faced with the Ford-GM plan, would be the cost of the total package. While the 5¢ per manhour itself would be just another nickel's labor cost, the total package of 20¢ or thereabouts might be more than the smaller automakers can absorb or pass on to customers. And it's possible that the 5¢ per manhour levy agreed to by Ford and GM wouldn't be enough to finance the plan in the independent plants because of more uneven production patterns there.

While the Ford-GM-UAW agreement as it stands does not constitute a true guaranteed annual wage, it does constitute the entering wedge in a new era of collective bargaining. Although the immediate cost, liability and benefit scales are modest, the possibilities for their expansion are immense.

What About GAW and Other Metalworking Industries? It'll Be a Long Time Coming

WASHINGTON—The question management men in Metalworking plants all across the country are asking today is "when will the guaranteed annual wage hit me?" Washington labor experts have some reassuring words for them—it looks like GAW will be a long time coming in other industries.

There are two good reasons for this: (1) the spread-out multi-plant bargaining of the AFL International Association of Machinists, and (2) the lack of concerted bargaining strength of the CIO Electrical Workers' Union.

Even IAM President Al J Hayes discounts the importance of the guaranteed annual wage drive in the many thousands of companies with which his union negotiates. There's a big difference between the United Auto Workers bargaining with half a dozen big firms, and IAM bargaining in hundreds of separate encounters with both small and large firms, where it would be virtually impossible to make a package agreement.

In the case of the CIO Electrical Workers' Union, the pattern setters in the industry are General Electric and Westinghouse.

IUE members working for the auto companies picked up the auto union's contract, but there's almost no chance that IUE's President James Carey could do the same with GE or Westinghouse. The union is not particularly strong in either company, and it's a red-letter day when they can raise the ante offered by either firm in a settlement. IUE's chances of winning GAW are slight.

One thing you can bank on throughout Metalworking — where plants are operating on regular schedules, the issue will still be wages—not unemployment compensation.

SAE LOOKS AT THE FUTURE:

The Problem — Meeting Higher Demand with a Smaller Workforce

ATLANTIC CITY — A round table discussion of manufacturing research programs was a feature of the Golden Anniversary summer meeting of the Society of Automotive Engineers held here June 12 to 17.

Introducing the discussion, K W Stalker, supervisor of manufacturing process development at General Electric's Evendale plant, stressed the necessity of meeting rising consumption rates with the limited workforce that will be available. This will make it essential for metalworking plants to study new materials and processes and learn to incorporate them in manufacturing as quickly as possible.

Thompson Products has recently started a group working in advanced manufacturing methods, reported W M Williams, asst mgr of the Jet Div. This group will concentrate on methods far in advance of present methods. The process development group will continue to work on current manufacturing research, as in the past.

Research programs don't have to be elaborate, Joseph Crawford, Cincinnati Milling and Grinding Machine Co, pointed out. He cited the ease with which limited research can establish optimum machining rates for a particular operation. He described a milling setup calculator that will shortly be available to aid in this operation.

Basic research by Ex-Cell-O in the machining of jet engine buckets and blades was described by L Zimmel. After four projects had been failures, a fifth project produced data that led to the development of machines that led to the establishment of three plants by Ex-Cell-O to machine these blades.

In a panel on materials and processes for tomorrow, M E Nevins, pres, Wisconsin Centrifugal Foundry, Inc, described development of centrifugal casting of titanium alloys. The casting machine is enclosed in an air-tight jacket with the titanium in an upper section separated by a molybdenum plate. The titanium is melted by manual manipulation of a tungsten electrode through the top of the jacket. When the pool of molten titanium has been built up, a hole is burned in the molybdenum plate to let the titanium run through into a graphite mold.

Future aluminum applications in automobiles were discussed by L F Swoboda. Because of the high heat conductivity of aluminum, it seems to be an ideal material for brake drums and wheels. Such drums are now being tested by several firms.

Bright finished aluminum will make its appearance in radiator grills in the next year or two, Mr Swoboda predicted, and later in bumpers and hubcaps.

Several research projects on die-cast aluminum blocks are showing promising possibilities, but much development work remains before such blocks will be generally adopted, Mr Swoboda concluded.

REPLACEMENT IN NEW ENGLAND:

"No Tool Over 5 Years Old" Is This Shop's Goal

BRISTOL, CONN — It's Associated Spring Corp's ambition to modernize until no machine in its plants is more than five years old—with a few special exceptions. To achieve this goal, the company has spent $13 million since WWII to expand and modernize its 11 divisions.

Reorganization, Too

Not only replacement and modernization, but reorganization of manufacturing facilities plays a big part in the revamping of Associated's 11 divisions. Take the company's Wallace Barnes Co division, for instance. This 100-year-old firm, founded to make clock springs and wire hoops for crinoline skirts, today will make you "one spring or a million"—and it makes a profit in either case.

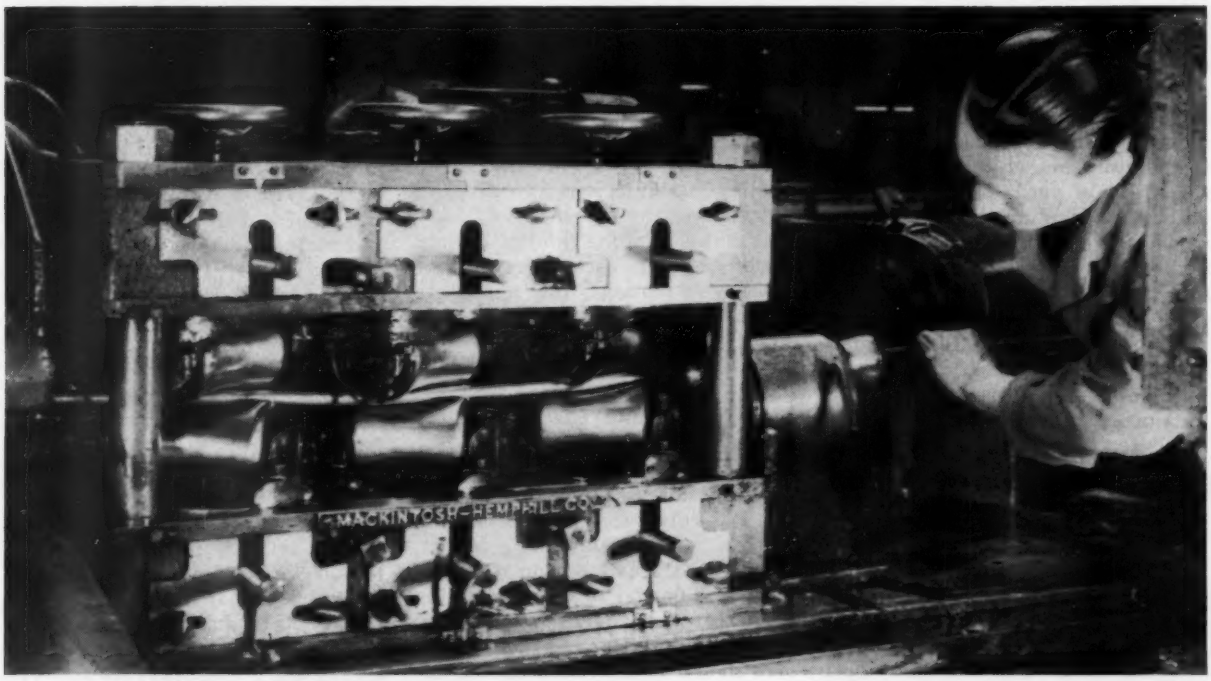
Barnes' manufacturing setup has been reorganized completely to speed up output of wire springs and intricately formed sheet-metal parts. How? Its power presses and its wire-forming machines are departmentalized by (1) function, and (2) size. In other words, an integrated toolroom in each manufacturing department provides faster service, cuts setup delays, and gives its operators more chance to become skilled and specialized than when centralized facilities are used.

New Equipment Is Reworked

In the spring-making departments, for example, the newest types of machines are used, with emphasis on accessibility for tooling setup and servicing. This new equipment has been reworked by Associated's engineering and mechanical departments to make it even better suited to the plant's needs. Old power presses, with a 5000-pc-per-hr capacity, have been replaced with high-speed presses capable of turning out 30,000 pc per hr, and with greater accuracy and power. Press capacities now range from 1 to 100 tons, including high-speed hydraulic presses.

Associated's Wallace Barnes Rolling Mill Division in Bristol is installing a new $1-million Sendzimir mill, including annealing equipment, for production of thin-gage, high-carbon strip (down to 0.002 in.).

Is Associated's replacement, modernization and reorganization program paying off? Look at the financial record—its plant asset account has more than doubled since 1945. And its sales thus far in 1955 are well ahead of last year. All modernization has been paid out of earnings —another way of saying that modernization pays off in a big way at this old-line New England firm.



US-Made Tube Straighteners Increase British Firm's Output

TWO AMERICAN 6-ROLL GUIDELESS rotary tube straighteners, manufactured by Mackintosh-Hemphill of Pittsburgh and installed at Accles & Pollock Ltd's Oldbury, Birmingham, England, plant, are reported to have increased production of ⅛ to 1 in. OD seamless or welded drawn steel tubing 15% in the year that they have been in operation there. Each one-man-operated unit produces between 4000 and 5000 ft of tubing per hr to straightness specifications of less than 0.010 in. deviation per ft

ASME MEETS: Headliners—Grinding and

First reports on such developments as improving surface finish by using small, high-frequency vibrations in grinding, and use of inorganic salts for grinding titanium were among the Metalworking attention-getters at ASME's semi-annual meeting in Boston — along with some new developments in today's top topic — automation

BOSTON — Several important new steps in metalworking methods were reported for the first time at the Diamond Jubilee semi-annual meeting of the American Society of Mechanical Engineers held here June 19 to 24. Grinding and automation were the principal subjects covered in sessions of interest to production men.

Small vibrations at high frequencies can improve surface finish according to tests reported by Prof L V Colwell, Univ of Mich. Vibrations were induced between the work and the grinding wheel by vibrating specimens with an ultrasonic transducer.

Other effects were reduction in thermal cracks, marked reduction in temperature, and ability to minimize the effects of variations in hardness within the grinding wheel. Grinding wheels tend to break down faster with vibration. In one series of tests the grinding ratio was about 40 with conventional grinding compared to about 25 for the vibrated specimen.

Dr Colwell is now conducting tests of a similar nature on machining operations.

Higher Work Speeds

The tendency of heat checks and cracks to form in the work can be reduced or eliminated by higher work speeds, reported Dr R S Hahn, consulting engineer, Heald Machine Co.

A set of 20 triple-carbide tools were ground on a rotary surface grinder at a work speed of 600 fpm, and a comparison set of 27 tools ground by conventional means at 20 fpm, with the same type of diamond wheel.

The high work speed produced 20 good tools out of 20; the low work speed produced 12 good tools out of 27. On an interrupted-cut boring test, tools ground at 600 fpm produced 8.3 parts per tool. Parts ground at 20 fpm produced 3.1 parts per tool.

Grinding Fluids for Titanium

A systematic study of inorganic salts for grinding titanium was reported by Prof M C Shaw, Mass Inst of Technology, and Dr C T Yang, research engineer, Ford Motor Co.

Strong indications of chemical action between aluminum-oxide grinding wheels and titanium have been reported previously (*AM*—June 11, '51, p150). This appears to be explained by the electrostatic bonding forces created by the similar size of the oxygen ions (negative) and the titanium ions (positive).

Results of the present study indicate that a grinding fluid of barium phosphate (the barium has strong positive or cations, the phosphate has strong negative or anions) produced the best grinding ratio. Unfortunately barium phosphate is insoluble, but barium hydroxide has been found quite effective and is noncorrosive on steel parts of the grinding machine.

During discussion, serious objection was raised to the use of barium because of its highly toxic nature. Dr Leo Tarasov, Norton Co, felt there was danger of oil mist getting in the air and being breathed by the operator. He felt that great care should be exercised in suggesting the use of any material that might introduce a health hazard into the shop.

Another point brought up in discussion was that the method used in this research might point the way to other basic research in cutting fluids.

Development of Automation

Key events in the development of automation were traced by Anderson Ashburn, special projects editor, *American Machinist*. He concluded that they did not represent a second industrial revolution, nor a revolution at all, but a logical step in the evolving science of production methods.

At the same time, Mr Ashburn said, there is a broader approach involved in automation than there is in mechanization that justifies the use of a special word. He recalled the origin of the word by Del Harder at Ford and told about the internal discussions on *American Machinist* that led to the first publication anywhere of the new term (*AM*—Oct 21, '48, p107).

Among the interesting early developments that have led to the present concept of continuous automatic production, were the grist mill designed by Oliver Evans in the 1780's that contained an ingenious combination of belt conveyors, screw conveyors, and endless-chain buckets that took the grain automatically through cleaning, grinding, and bolting.

The first true transfer machine appears to have been built in England in 1924. This machine, at the Morris automobile plant, was 181 ft long and carried cylinder blocks through 53 operations.

The earliest example of tape control for a machine appears to be the boiler-plate punching machine built by Sellers in 1905, and the first example of feedback on a machine tool was an automatic sizing device on internal grinders built by Bryant Chucking Grinder in 1931.

Automation, Mr Ashburn concluded, can be a good, convenient word for engineers, and for laymen, too—if we can lay the ghost that it is a concept that is new and revolutionary to industry, and new and dangerous to labor. "Hoping not to add to the surfeit of definitions we already have," he said, "I would like to say that automation is a fact. We can hide neither from the word nor the concept for which it stands."

Maintenance Costs in Automation

The system developed to maintain the Ford Cleveland Engine Plant

Automation

was outlined by Norman K Conrad, supt of general maintenance. Maintenance data on any machine for any period of time can be obtained at a moment's notice.

All time sheets, hourly forms, and requisitions pass through the cost control unit and are posted on IBM cards. This information is used to highlight recurring weaknesses of any machine or equipment, cost of operating any machinery by single unit or department, and to supply engineering departments with data they may need.

Weekly reports are issued on maintenance cost for each area, Mr Conrad said, and on the ten pieces of equipment with the highest cost for that week. (The latter also show the year-to-date cost.)

General theme of the anniversary meeting was "The Engineer and the World of Science."

Air Force Guns B-52 Production Rate

Reaction to latest news of Russian power is a speedup, but not an increase, in bomber output and fighter output

WASHINGTON—The U S Air Force's reaction to recent startling disclosures that Russian air power is a long way ahead of what everybody over here thought it was has come fast. The Air Force has already ordered a 35% speedup in B-52 bomber output. And hard on the heels of this order have come similar orders to step up (to a lesser degree) production of McDonnell F-101 Voodoos and Lockheed F-104 day fighters.

The new decision on B-52's is the administration's first policy change in the face of major criticism that the U S has been going too slow in building up its air power. Conceivably, the B-52 production speedup may be the beginning of a costly program to beef up the Air Force—over and above current goals—to meet the growing Soviet threat.

To finance the accelerated B-52 production program, the Air Force asked Congress for a supplemental appropriation of $356 million in addition to the $5.59 billion already voted by the House for aircraft procurement. The appropriation was okayed by Congress in record time, along with an additional $10 million for Air Force research and development, and authority to earmark still another $50 million for research work. Appropriations for more McDonnell Voodoos and Lockheed F-104's are getting similar fast action from Congress.

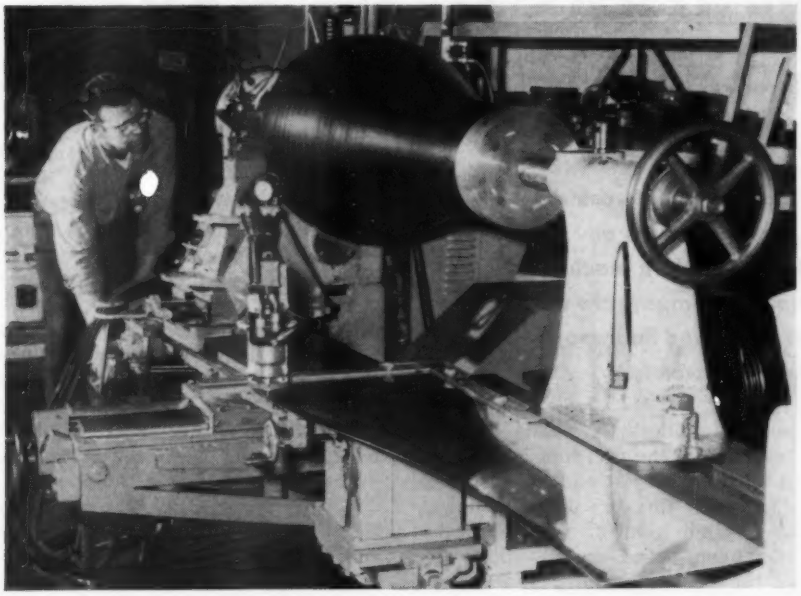
At the same time, the Air Force is seeking $10 million more for research and development, and for authority to earmark an additional $50-million for research work.

Significant Policy Switch

These actions came on the heels of statements made last month by Defense Secretary Charles Wilson that the Pentagon wasn't planning to step up aircraft production just because of new revelations of Russian air power. Obviously, there's been a significant switch in defense policy and on official evaluation of the Red air threat.

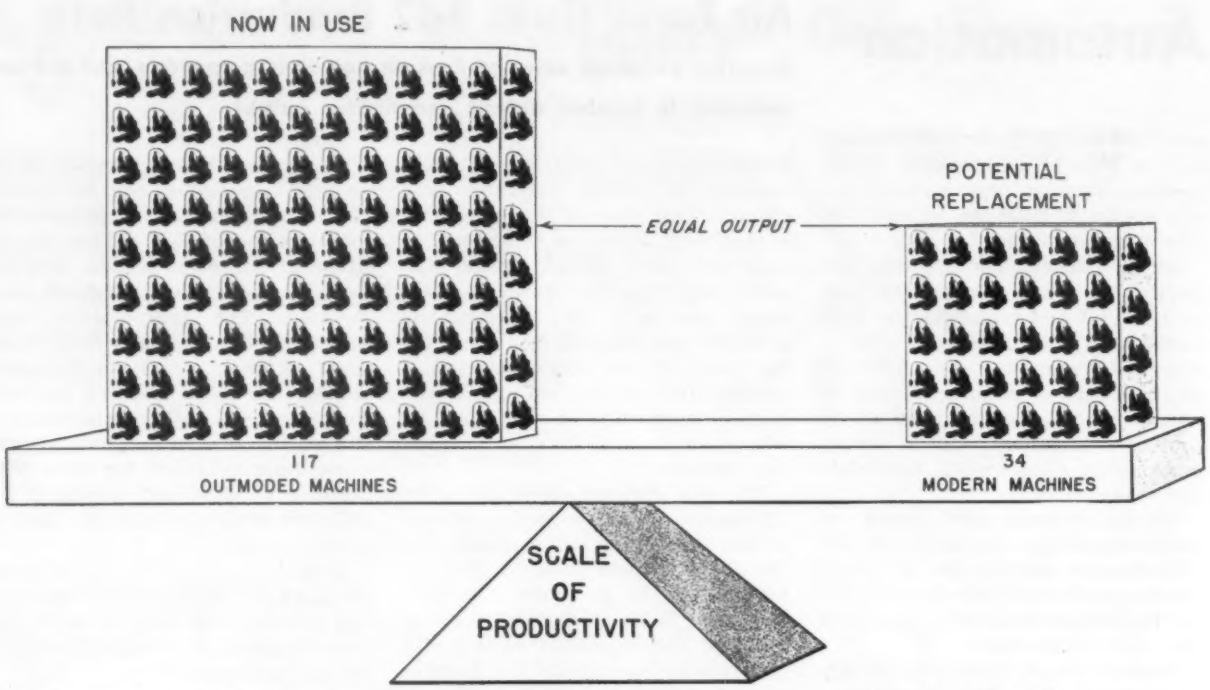
Previously, the defense department had tried to play down the significance of recently-revealed Russian progress in design and production of long-range jet bombers and supersonic fighters. This disclosure had stirred up a serious political rumpus, and had brought out congressional charges that the Eisenhower administration has been too complacent about U S air superiority over the Soviet Union. The new decisions stem from these factors.

The B-52 speedup does not mean that more of the bombers will be built than was originally planned—at least right now. Rather, it means production of more aircraft each month until the present 500-plane objective is achieved. Under the new program, the U S will have an armada of B-52 planes in 1958, one year earlier than originally planned, allowing a faster replacement of B-36's. The additional funds are needed to pay Boeing, the B-52 contractor, for deliveries ahead of current schedules.



Tracer Unit Fabricates Chuck On Spinning Lathe

REQUIRING ONE-TENTH THE TIME OF PREVIOUS METHODS, this tracer unit developed by Douglas Aircraft is used at Douglas's El Segundo, Calif, plant to duplicate the configuration of a flat pattern on a round section, enabling tools to be fabricated on a spinning lathe. Conventional lathe carbide tip cutter is actuated by a hydraulic tracer valve from responses received as the stylus moves along the templet. Transit mounted on the head stock positions center line of the templet in parallel with lathe's axis. Tolerances of plus or minus 0.005 in. can be achieved with this method



117 OBSOLETE TURRET LATHES could be replaced with only 34 modern machines in U S Naval Shipyards

NEW MACHINE TOOLS for the NAVY?

Shipyards Could Be Completely Modernized in Five Years

BuShips survey of the Navy's 12 biggest metalworking operations has come up with some startling facts on machine tool replacement. For instance, modern machine tools would save the Navy more than 3000 manyears annually; they'd save thousands of square feet of needed floorspace—and they'd pay for themselves in five years or less

WASHINGTON — The nation's 11 Navy shipyards, and the ship repair facility at San Diego, Calif, would be completely modernized over a period of five years under a plan of the Bureau of Ships that calls for replacement of 3496 obsolete machine tools with 2474 new machine tools of today's design.

The proposed plan, based on operation of 2½ shifts under mobilization conditions, would save 3099 manyears annually, as against use of present equipment, and 76,430 sq ft of floor space. The savings would be so great that they would enable the Navy to recover its invested capital within five years.

Survey of the first phase of the plan has been completed. As a result, a request for funds to cover one-fifth of the program is to be put into the Navy's budget for fiscal 1957, beginning July 1, 1956. The survey is not a hit-or-miss affair, but has been based on an application of the MAPI formula, modified and simplified. The entire project is under the direction of Commander Alfred J Weisbecker of BuShips.

Under study for some time by BuShips, machine tool builders, and the Machinery & Allied Products Institute, the Navy replacement plan went into its first phase of action last February, when BuShips received the green light to survey its 12 major metalworking installations —the 11 shipyards and the San Diego ship repair facility.

The MAPI - based replacement analysis reports from the Naval shipyards have been satisfactory for the general run of machine tools. But in the case of elephant tools, special analysis procedures are necessary:

- A special list of elephant tools having a primary service life of more than 20 years has had to be established. These tools are generally difficult to justify for replacement because of (1) the low increase in productive capacity of the new tool, and (2) the relatively long setup time required as compared to the short machining time.
- Disposal values for elephant tools are given special consideration and adjusted upward.
- A primary service life for elephant tools having 20 years or more of use has been established — and a corresponding adjustment must be made in yearly depreciation.
- In the case of some elephant tools, it is more advisable to rebuild than to replace. In such instances, the primary service life of the rebuilt machine is reduced to 50% of its

new machine equivalent.

Since February, the 12 facilities have submitted from 100 to 300 analysis sheets each, covering some 5000 machine tools. These are being used as the basis for a BuShips budget request for the program. Among other things, the survey revealed that the majority of Navy machine tools are in the 11-15 year-old bracket, predating the "carbide age," and definitely below modern machine shop standards.

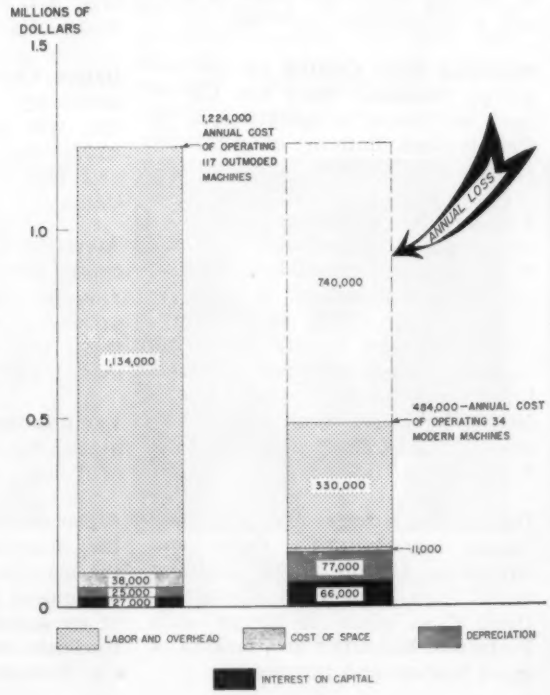
The present BuShips replacement plan avoids a glaring error common to its predecessor programs: its replacement needs are based on full mobilization requirements. According to Commander Weisbecker, "Peacetime usage data has no more place in our calculations when considering replacement of industrial equipment than it has when considering replacement of the fleet." Thus, the BuShips plan is based on the assumption that the machines will operate 5000 hours a year, or roughly 2½ shifts.

BuShips, which ultimately hopes to institute and control machine tool replacement in the Navy's industrial reserve plants as well as in its shipyards, has these points in mind in the administration of its replacement program:

- Centralized administration of the plan by one man or one BuShips department.
- Development of a procedure for informing management of replacement opportunities in the plant.
- Periodic review of all equipment to determine replaceability.
- Maintenance of adequate cost records.
- Realistic approach to top-level management participation.
- Preparation of equipment budgets based on knowledge of overall replacement opportunities, and on computations showing the loss that will result if replacement is not made.
- Provision for a regular post-audit of replacements to check actual against anticipated results.

While the BuShips plan will ultimately embrace replacement of metalworking equipment other than machine tools, the latter were chosen as the first goal of the program because they promise the greatest return in the shortest period. It is planned to spread the machine-tool replacement phase of the program over five years, beginning in fiscal 1957. An important by-product of the program during this period will be the training of machine operators in the application of carbide tooling and related technologies incorporated in the new machines.

Comparative Costs Outmoded vs New Turret Lathes



IT WOULD COST the Navy more than $1.2 million a year to operate 117 outmoded turret lathes in BuShips installations, contrasted with only $484,000 to operate the 24 modern machines that would replace them

WORLD NEWS ROUNDUP

Both American Motors and Chrysler have big plans for **Australia.** AMC intends to build an assembly plant for Hudsons, using 20-25% Australian-made parts, later increasing the percentage until a Hudson is completely manufactured Down Under. Chrysler is buying a 170-acre site in Adelaide as a center for its seven plants in that area. Chrysler Australia's present 1.25-million-sq-ft of assembly and manufacturing space, and its workforce of 4500 will be considerably expanded as Chrysler goes gunning for Ford and GM's Australian markets . . . **Russia** is trying to sell road construction machinery on the world market, even though its own roads are in a critical state of disrepair . . . The **Japanese** government is cutting production of sheet steel 15-20% to alleviate a market crisis . . . **British** auto output, like U S, hit an all-time high in the first quarter . . . **Russia**'s machine tool makers are complaining that shortages are forcing them to make their own lathe chucks, parallel vises, and machine vises. They're urging that Russia set up plants to make such equipment "to place tool manufacture on a broad footing and eliminate primitive methods" . . . Willys Motors is setting up a Jeep assembly plant near Istanbul, **Turkey** . . . **Italy**'s FIAT expects to turn out 1000 cars a day in the near future . . . Two more **Japanese** firms—Asahi-Okuma Industry, and Tokyo Precision Machine Co—have received substantial money grants under the MSA Wheat Grant Program. They'll make ammunition with the wheat money . . . **England**'s David Brown Machine Tools Ltd reports receiving a $100,000 order from a U S firm (name undisclosed) for two gear hobbers . . . **Australia**'s Freighters Ltd and Lunn Laminate Co of New York will make molded plastic auto bodies in Australia . . . A U S firm is reported to be interested in manufacturing auto and truck parts in **Cuba**—if that country's government meets the firm's tax concession request . . . Longren Aircraft de **Mexico**, a U S affiliate, will manufacture single-engine passenger and crop-dusting planes at Mexico City's Central Airport . . . **Canada** is dickering for manufacture of **Australia**'s pilotless target jet aircraft, the Jindivik . . . Greenfield Tap & Die Corp has joined forces with Bofa Drill Factory to form Greenfield Tap & die (Holland) N. V.

NEW HOME FOR WILTON TOOL Mfg Co is this modern, 68,000-sq-ft office and manufacturing plant at 9525 Irving Park Rd, Schiller Park, Ill.

OPEN HOUSE at G W Brunton & Son Inc, Kenmore, N Y, machine tool distributors, marked the official opening of that firm's new demonstration building, where machines of seven major machine tool builders were demonstrated under power

Companies in the News . . .

Jones & Lamson Machine Co in a diversification move has purchased **Shopmaster Inc,** Minneapolis, makers of power tools for the home workshop. Shopmaster makes circular saws, jointers, planers, jig and sabre saws, drill presses, sanders, and a multi-purpose tool that can also be used in light professional applications. New officers of Shopmaster are Hardage L Andrews, president (Mr Andrews is also president of J & L); L H Miller, vice president and general manager; E R Koester, vice president manufacturing; H H Whitmore, treasurer; and N T Harrison, secretary-controller.

Transitier Truck Co, Portland, Ore, makers of fork lift trucks, has moved to new quarters, will increase its machine work and fabricating facilities.

Lees-Bradner Co, Cleveland, has been licensed by **Grob Inc** to manufacture and market the Grob gear rolling process.

Chrysler Corp plans to boost output of its Youngstown, Ohio, stampings plant 25-30% by enlarging its facilities and transferring 22 presses in from one of its Detroit plants. About 150 new jobs will be added to the present 450.

Ford Motor Co plans to build a 950,000-sq-ft engine plant at Lima, Ohio, slated for full output in 1957, when it will employ about 4000 people—1600 more than the total unemployed in Lima and Allen County.

Fruehauf Trailer will build or buy a plant in either San Francisco or Seattle for output of its Volume Van Trailers.

Hammond Mfg Co, Pasadena, Calif, has formed a subsidiary, **Air Logistics Corp,** to specialize in development and production of Hammond-designed aircraft and guided missile support equipment.

A V Roe Canada Ltd has offered to merge with **Canadian Car & Foundry Co Ltd** to broaden the industrial base and commercial outlets of the two firms. The move is subject to stockholder approval.

Michigan Steel Casting Co has acquired **Standard Alloy Co,** Cleveland, will move its operations to its Detroit plant. Both are alloy casting companies.

Underwood Corp, typewriter and office machine manufacturers, plans to relocate and consolidate some of its scattered operations in a multi-million-dollar plant at Hartford, Conn. The new facility would incude the present Hartford manufacturing operation, the company's Long Island, N Y, laboratory, and Underwood's main offices, now in New York City.

Casalbi Co, Jackson, Mich, has purchased manufacturing rights and equipment for the Globe tumbling barrel from **Hupp Corp,** Cleveland. Hupp Corp plans to merge with **Perfection Industries Inc,** makers of space heaters and furnaces.

Mathews Conveyor Co, Ellwood City, Pa, is celebrating its 50th anniversary with completion of a three-story office building, and two major plant additions that are increasing manufacturing area 30%.

United States Time Corp, said to be the world's largest watchmaker, is going into mass production of electric timers for industrial and domestic applications.

Automatic Washer Co, Newton, Iowa, is talking merger with **Washer-Dryer Corp.**

Minneapolis-Honeywell Regulator Co's Heiland Division plans to build a $1-million instrument plant near Denver.

Bostitch Inc, makers of staplers and stapling machines, will move its main plant and offices from Westerly, R I, to a new, larger plant in East Greenwich, R I.

Dalmo Victor Co, San Carlos, Calif, subsidiary of Textron American Inc, will consolidate all its electronics manufacturing facilities in a new $1.2 million plant at Belmont, Calif.

American Brake Shoe Co has purchased **Denison Engineering Co,** Columbus, Ohio, maker of hydraulic presses, pumps, and automatic controls, will operate it as a wholly owned subsidiary.

Lamb Industries Inc, Toledo, has acquired **Air-Way Industries Inc,** also of Toledo.

Airborne Instruments Laboratory Inc, Mineola, L I, N Y, is entering the machine tool and metalworking equipment field with the marketing of an automatic gear gage through **Burleigh and Stocker Machine Tool Co,** Pleasant Ridge, Mich.

KEARNEY & TRECKER CORP APPOINTMENTS .. Henry H Lentzner (left), manager of the special machinery division, to vice president, manufacturing; **Renald F Zemke,** manager of the process engineering department, to works manager of the standard machine division; and **John P Bunce,** supervisor of processing, standards, and production control, special machinery division, to staff assistant to the manufacturing vice president

Names in the News . . .

Frank W Rickard, director of manufacturing services of Borg-Warner Corp, has been elected president and general manager of the corporation's Mechanics Universal Joint Division. He succeeds **Arch A Warner,** who retired in May. **Chester E Palmer,** vice president and assistant general manager of the division, has been named executive vice president.

Aro Equipment Corp (Bryan, Ohio) appointments: **Marquard J Anderson,** assistant to the president, to a vice president; **J R Markey,** assistant to the vice president, named a director; and **Norman J Sine,** Air Tool Division manager for North Carolina, to division manager for Western Missouri.

Harold Ruehl, formerly chief tool engineer for International Harvester Co's Industrial Power Division, has been appointed assistant chief engineer of Erickson Tool Co, Cleveland, Ohio.

F P von Meyer, formerly production manager of Bohn Aluminum & Brass Corp's Bearing Division, has been appointed production manager of W H Anderson Co's Manufacturing Div, Detroit producer of investment castings.

J A Jean, formerly associated with Niles-Bement-Pond Co's Pratt & Whitney Division, has been appointed vice president and general manager of Bell Equipment Co, Los Angeles.

Grosvenor S McKee, vice president, Talon, Inc, and chairman, Hall Planetary Co, and **Dr John W Harriman,** professor of finance, New York University, have been elected directors of the Van Norman Co, Springfield, Mass. **James Y Scott** will serve as chairman of the Van Norman executive committee, in addition to being president. **Herbert I Segal** has been named vice chairman of the executive committee in charge of the company's program for acquisition, finance, and public relations.

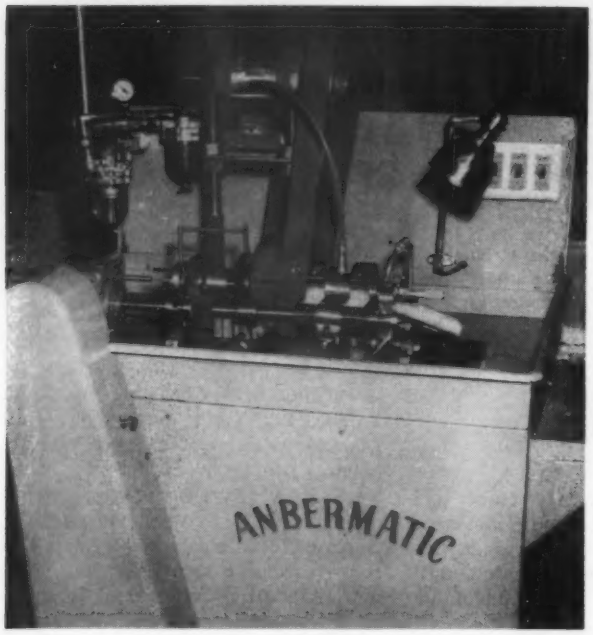
Charles B Lansing, Jr, secretary and treasurer of Ferry Cap & Set Screw Co, Cleveland, has been elected president to succeed **H D North,** named chairman of the board. **W H North,** assistant secretary and assistant to the president, has been appointed vice president and secretary.

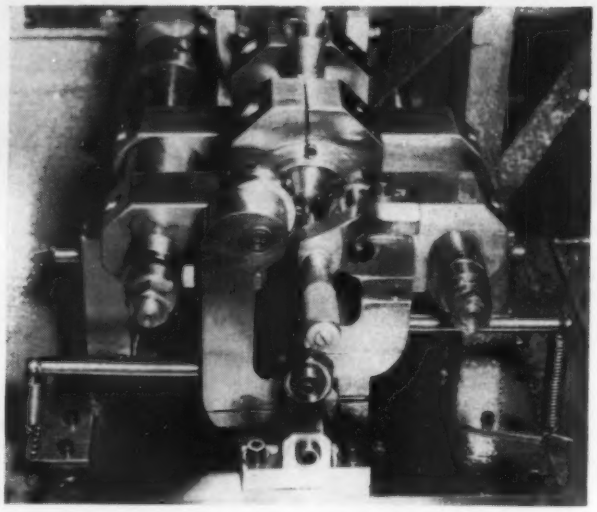
John C Molinar, formerly vice president, general sales manager, and director of Niles-Bement-Pond Co in charge of sales of the Pratt & Whitney Div, has been appointed general sales manager of Union Twist Drill Co

Paul W Norris, director of sales of The Denison Engineering Co, has in addition, been named vice president

Otto W Franke, operating manager of Chrysler Corp's Dodge Div, has been appointed manager of the newly created Central Production Engineering Dept

New Shop Equipment





CAM-FED ROCKER-ARM mechanism, shown in this right-side end view, is used for cutting and forming operations. Cams are designed with no idling time on front or back

Form and Cutoff Screw Machine Combines High Speed With Accuracy

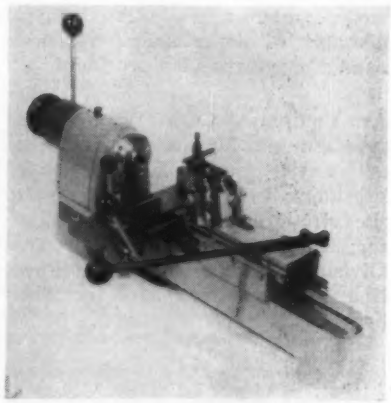
The Anbermatic high-speed form and cutoff screw machine is offered in three models. No. W093 will take diameters from 0.0000 up to 0.093 in.; No. W187 to 0.187 in.; No. W312 to 0.312 in. Spindle-speeds are 12,000-16,000, 9000-12,000, and 7000-9000, respectively. The spindle unit, incorporating precision ball bearings, is reportedly designed so that it and the feeding mechanism can be dismantled and assembled within one hour; also so a new job, with proper cutoff tool, feed finger, and chuck, can be set up in less than an hour. Norgren Micro-fog system provides lubrication for the bearings on the spindle.

The machine is not equipped with cross slides but with rocker arms which are cam-fed and will hold tolerances on diameters at slow speeds (3000 to 5000 pieces per hour) as close as 0.001 in. With speeds from 7000 to 10,000, on soft metals, it will hold as close as 0.0015 or 0.002 in. The Anbermatic requires no facing-off operation and will hold tolerances on lengths to 0.0005 in., including the cutoff burr. This tolerance can be held with speeds to 8000 to 10,000 pieces per hour on soft metals. Tolerance of 0.001 in. can be held with speeds up to 12,000 pieces per hour.

The complete feed-out and cutoff time of the spindle is 1/25 of a second. The machine can run at a speed of 15,000 pieces per hour on diameters up to 0.225 in. and lengths to 0.625 in. on brass or aluminum. It will run as high as 5000 to 7000 on certain steels.

Models 187 and 312 of the Anbermatic can be equipped with a drilling attachment as well as a sawing unit. This sawing attachment is for tubular stock and can saw pieces in lengths up to 0.750 in. long at a speed of 8000 to 10,000 pieces per hour. Due to the precision holding mechanism of this saw attachment, pieces can be cut free of burr on both inside and outside diameters. Prices of the units are: No. 093, $4358; No. 187, $4687; No. 312, $5070. The sawing unit is available for $371.

Winchester Mfg Co, Inc, Winchester, NH



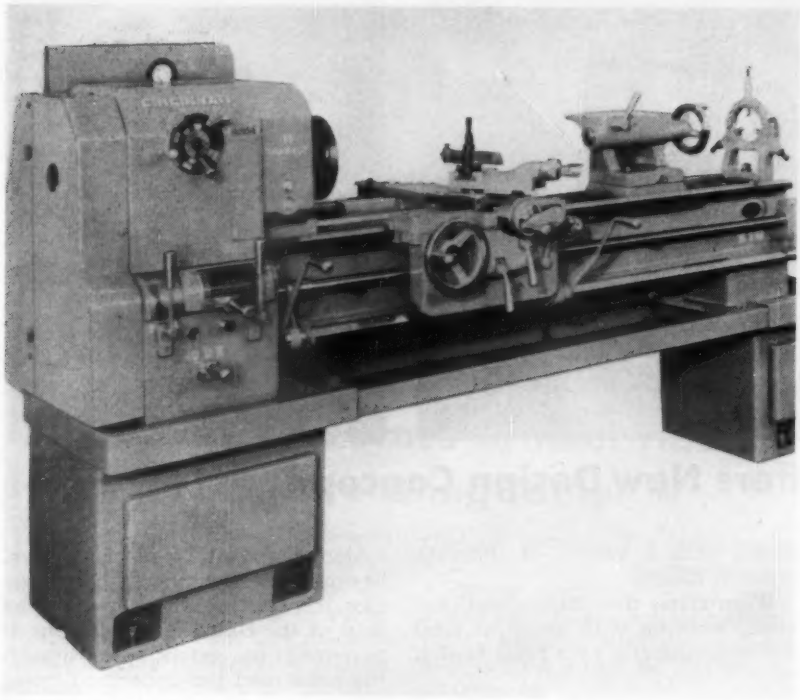
Instrument Lathe Has Half-Inch Capacity

Model A lathe for fine precision work has a ball bearing headstock with a runout of less than 0.0001 in. It is equipped with lever collet closer, V-belt, 6-position turret with ⅝-in. holes for tools, double compound slide rest with rack and pinion cross slide, and front toolpost with 360° swing.

Over-all length is 24 in.; bed length, 22 in.; swing 5.905 in. Spindle speeds with variable speed drive up to 10,000 rpm are provided depending on pulley ratio.

F W Derbyshire, Inc, Waltham, Mass

Materials and Parts . . .



Cincinnati Tray-Top Engine Lathes Provide Swing From 10 to 18 in.

New all-geared-head Model LE engine lathes in 10, 12½, 15, and 18-in. sizes are announced by Cincinnati Lathe & Tool Co, which reports the machines provide modern, low-cost equipment for manufacturing, maintenance, and toolroom use. The lathes have 12 spindle speeds in geometric progression, with a three-lever, color-match, direct-reading shift mechanism. The spindle, with long-taper-key drive nose, is rigidly mounted in three precision anti-friction bearings. All headstock bearings are pressure-lubricated with filtered oil.

The totally enclosed, automatically lubricated quick-change gearbox allows 48 thread and feed changes. Fully enclosed electrical compartment houses control equipment with built-in disconnect switch to protect operator from exposing a live panel. Power is transformed from 220 volts and over to provide 110 volts at the pushbuttons. Lathes are offered with 1-, 1½-, 2-, or 3-hp motor mounted on the rear of the headstock leg.

The apron is a one-piece double-walled casting with automatic lubrication. Longitudinal and cross feeds are engaged with drop levers operating positive jaw clutches, and a spindle start-stop control lever is supplied at the apron and quick-change box.

The bedways are ground and will be Hardclad flame-hardened on demand. Lubrication of the carriage ways and cross slide is provided by an oil shot system in the apron.

Tray-tops on headstock and tailstock provide safe parking space for mikes, tools, drawings, etc. Recessed, precision built-in leveling jacks and cabinet legs with easy opening doors are other convenient features. Unit will be shown at the Machine Tool Show.

Cincinnati Lathe and Tool Co, Cincinnati 9, Ohio

. . . including

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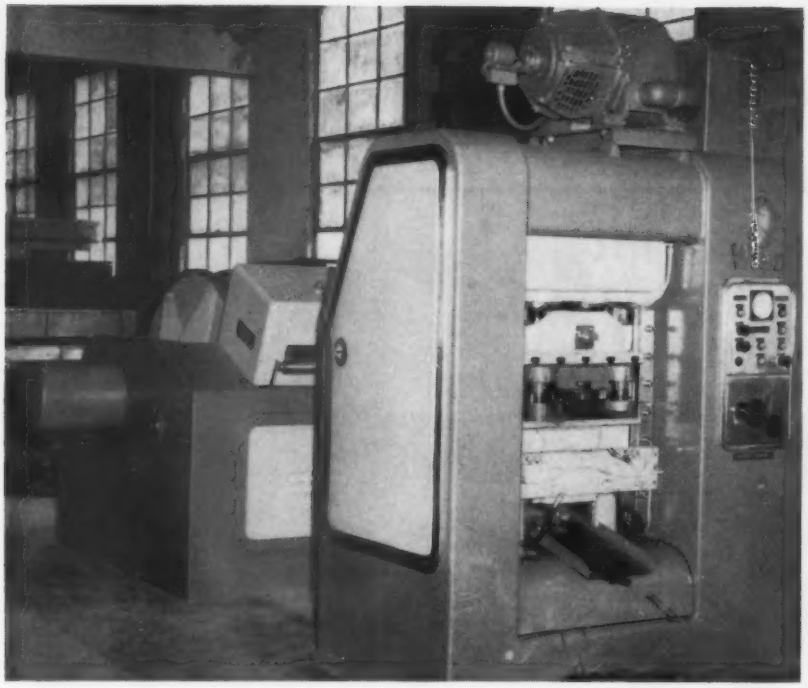
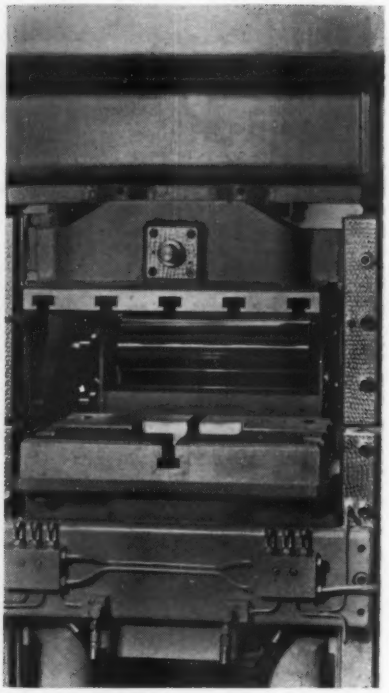




Wean Flying Press Offers New Design Concept

Wean reports that its new Flying Press is a new concept of press design with high operating speed as its objective. Pictured is a 60-ton hand-built prototype which has operated with a variety of different types of diesets.

Wean states that the conventional press, working with a coil of steel fed intermittently by a press feeder, seldom reaches a speed of 150 spm. The new press eliminates the necessity for starting and stopping the feed of the coiled steel, allowing it to move at continuous speed through the press, and the upper and lower dies move forward and synchronize with this speed during the time in which the stamping is performed, reportedly increasing the production rate as well as giving greater accuracy to the length which is fed into the press. Production is said to be as high as 600 to 900 spm.

The idea of dies which move with the strip as the work is being done is not new in itself, but only the method by which it is accomplished here, using a mechanism patented by the Wean Equipment Corp.

The press is also said to have advantages in the matter of maintenance and downtime. A conventional press uses a clutch and brake to actuate the ram, the two units working every time the press makes a stroke. The Flying Press has neither clutch nor brake. It has no flywheel, as such, but stores its energy in the motion of dies and die-holders. Because the strip never stops as the speed increases, the velocity of the completed part allows ejection with greater ease.

The press has been designed as a packaged unit. All controls have been brought to a stainless steel panel at one side of the machine.

Wean Equipment Corp, 22828 Lakeland Blvd, Cleveland, Ohio

Automatic Gear Gage And Hobbing Machine Control

AIL Type 80 automatic gear gage and hobbing machine control sorts gears according to production tolerance limits, and permits control of the machine to prevent production of scrap and reduce gear-making costs. (Details, *AM*, June 6 '55, p123).

Sorting gears according to tolerances established by the user, Type 80 can handle up to 1000 gears per hour. Automatic indicators signal when pitch diameter falls outside allowable limits, also indicating when hob has begun to dull. Automatic circuit removes power from the machine if it produces too many gears outside tolerance limits. When used with a suitably equipped hobbing machine (having an electrically operated pitch diameter correction mechanism, and electrically operated hob shifter) the device automatically controls the machine both for pitch diameter and for hob shift to compensate for hob wear. It signals for the hob to be shifted when root fillet build-up reaches a preset limit. Hobbed gears are delivered by an automatic chute or conveyor, or by hand.

Type 80 handles a wide range of gear sizes; tolerances are adjustable from 0.0005 to 0.010 in. or more, each direction from mean gear dimensions; tolerance adjustments directly calibrated in thousandths. Repeatability of measurements is said to be better than 0.0001 in.

Airborne Instruments Laboratory, Inc, 160 Old Country Rd, Mineola, NY

Large Vertical Surface Grinder Has Hydraulic Reciprocating Table

Vertical-spindle surface grinder with hydraulic reciprocating table allows heavy stock removal on large die blocks or steel plates up to 54 in. wide and 144 in. long. The machine eliminates the necessity of planing operations prior to final grinding by producing ground finish surfaces from the rough rolled plate, or forged die block.

All parts of the grinder are extra-heavy to withstand the load generated by the 42-in. diameter segmental grinding wheel driven by a 125-hp TEFC V-belt main drive motor. The grinding wheelhead travels hydraulically across the table. When using the wheel the entire head is reciprocated on the crossrail by means of its own hydraulic system so the 42-in. wheel will cover the maximum working surface of 54 in. For certain operations an auxiliary head powered with 10-hp motor is used and the large head moved to the back of the machine.

The auxiliary head can be moved manually or hydraulically in a horizontal direction, manual movement being used for final positioning. It is also equipped with manual vertical movement to permit grinding of shoulders with side of wheel. The head can be provided with 12-in.-dia cup-type grinding wheel for finishing.

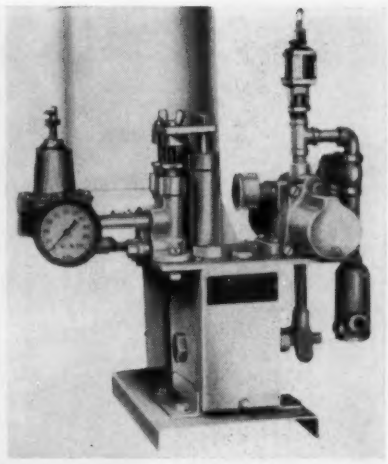
The 48x144-in. semi-steel table is reciprocated by two opposed bronze-lined cylinders and steel pistons with hydraulic pressure sealed by chevron packing. The low-pressure hydraulic system is complete with a 20-hp hydraulic pump motor coupled to a large-capacity hydraulic pump, together with the necessary flow control valve to regulate the table speed.

The grinder is equipped with two motors for the vertical movement of the entire crossrail and grinding heads. A 3-hp constant speed motor connected through a gearbox to the elevating screws raises and lowers the rail and head at 5 ipm. The second motor, a 1-hp gearmotor connected to the elevating screws through the common gearbox and a magnetic clutch is used for final positioning of the crossrail and feeding the large vertical-spindle head into the work. Precision feeding within 0.00025 can be accomplished.

A full-coverage magnetic chuck consisting of seven Hill rectangular chuck units provides ample power to securely hold work. A 2½-in. space between magnetic chucks allows miking pieces being ground and also permits handling hooks to be positioned.

A manually operated wheel dresser attachment redresses the 42-in.-dia grinding wheel. The dresser unit fits inside the grinding wheel guard and is engaged for dressing by turning a small handle located at the side of the spindle.

The Hill Acme Co, 1201 West 65th St, Cleveland 2, Ohio

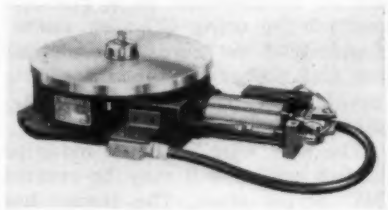


Manzel Automatic Lubricator For Abrasive Grinding Belts

Standard unit consists of an adjustable stroke pump driven by a reciprocating air motor, and incorporating a spray control cylinder that triggers the air only when the fluid is being delivered to the spray nozzle.

Controls are provided to accurately regulate frequency of application, amount of lubricant pumped per stroke, and air pressure at the nozzle. Model has a 2-gal. lubricant storage tank piped to the liquid cylinder, and is furnished complete with fittings, nozzle, and air regulator equipped with gage. Standard unit is recommended for belts up to 8 in. wide; larger belts can be lubricated by adding additional pumping units.

Manzel, 315 Babcock St, Buffalo 10



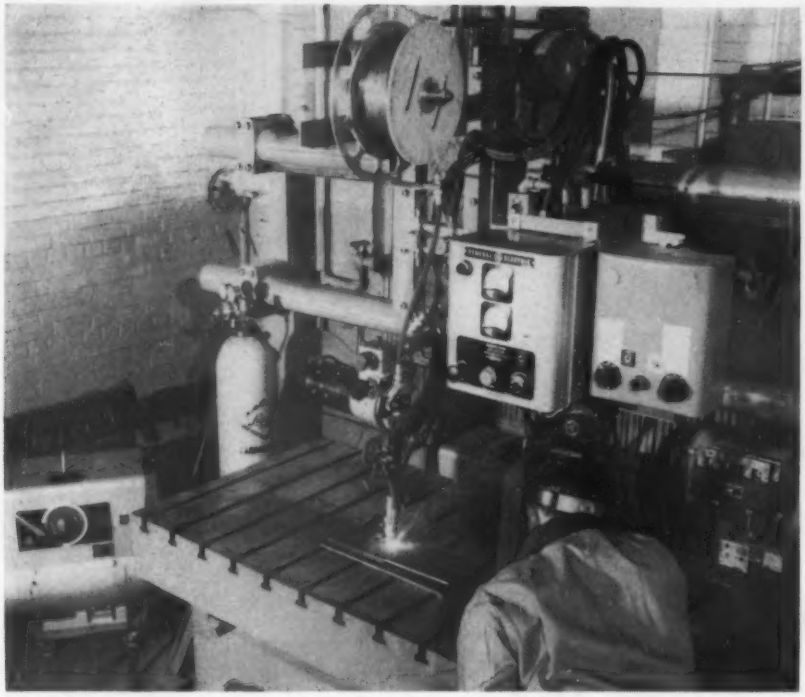
Rotary Index Table

New 13-in.-dia rotary index table, designated Model BRET-13, can reportedly maintain repeat accuracies as close as 0.0005 in.

Cam movement assures a positively locked table top at all times. Table is equipped with hardened and ground steel dowel pins which are engaged by hardened tool steel pawls to index the top and lock it in exact work position. It rotates on hand-scraped surfaces of the base housing.

Unit is available in three styles: one for fixed indexing of 4 stations; one adjustable for indexing either 6 or 12 stations; and one adjustable for 6, 9, or 18 stations.

The Bellows Co, Akron 9, Ohio



GE Welding Equipment Uses Carbon-Dioxide Shielding

General Electric has announced automatic, consumable - electrode welding equipment especially adapted for use with low-cost carbon dioxide shielding gas. The advantages of gas-shielded techniques can now be applied to mild-steel fabricating. GE states two advances which led to development of a practical method for using CO_2: an understanding of the need for a shorter arc and higher wire-feed speed in gas-shielded welding, and availability of dry, welding grade CO_2.

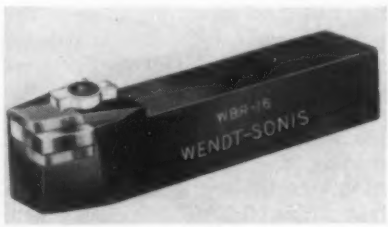
The new wire feeder is mounted at two angles and may be rotated 365° across seam. The feeder has twin driving rolls that are rubber insulated and require no adjustment. One model will handle electrode wire with range from 0.020 through 0.078 in. at feeding speeds to 1000 ipm. Another ranges from 0.062 through ⅛ in., at speeds to 600 ipm.

The 12-in. welding torch is water-cooled, has max current capacity of 800 amp. Nozzle splits in two to permit replacement of copper contact tip. Nylon liners guide the wire. The reel-mount takes 25 lb of wire, or, with adapter, will handle rim-mounted wire. A universal mount, it rotates in either direction and has adjustable brake.

The single control panel also does duty as an operator's station. It includes a dial calibrated for wire speed in 1000 increments of 1 ipm, start and stop buttons, voltmeter, ammeter and knob to adjust degree of crater filling. Arc length is set on generator.

The new Fillerarc control equipment may be set to multiple welding jobs. A number of welding heads may be operated from one master control panel.

General Electric, Schenectady 5, NY



Toolholder for Carbide Inserts

Wendt-Sonis holders for throw-away inserts are available in five styles and several sizes for LH or RH turning, boring, facing operations.

Separate solid carbide chip breaker can be clamped on top of the insert. Replaceable shim under insert protects holder body in event of damage. Steel or carbide shims are available with or without compound angles for inserts with neutral cutting rakes.

Inserts are furnished in utility or precision grades. Additional information in bulletin MTH-55.

Wendt-Sonis Co, Hannibal, Mo

Unit Chamfers Internal Gears From 2 to 20-in. Pitch Diameter

New universal Burr-Master deburrs and chamfers internal splines, straight-sided or involute-form helical and spur gears from 2 to 20-in. PD with a maximum of 4 DP. Throat clearance permits handling of parts up to 22 in. OD. Built to JIC standards, the BMI-15 can be supplied with automation for high volume production.

Unit chamfers both sides of the tooth and the root at one time at the rate of 5 teeth per second. It can also be used to deburr and chamfer certain types of external gears with adaptations in the tooling. Infinitely variable depth of cutting stroke assures maximum operating efficiency. When production must be shifted from one gear to another, only tooling components that need be changed are: spline driver; workholding fixture; toolholder and form tool; and, if number of teeth change, the change gears. Use of a three or four cutting edge, circular-type form tool insures long tool life and reduces time required to get a sharp cutting tool into position.

All shafts, pulleys, etc, are mounted in lifetime lubricated anti-friction bearings. Bearings that are not sealed for life are lubricated by a Trabon centralized lubricating system. Gearing in the rocker arm assembly runs in a continuous bath of oil. Coolant is not required for machining, but the unit is designed to incorporate coolant for flushing chips, if this optional feature is required. Over-all height is 80 in., with a 38-in. work height.

Modern Industrial Engineering Co, 14230 Birwood Ave, Detroit 38, Mich

FYI

FOR YOUR INFORMATION

FREE Catalogs, Booklets, Charts, Calculators

FYI—these initials symbolize information that's important. And there is much of importance in the literature listed here. To get the ones you need, all you do is fill out one coupon for each booklet you wish to order. Indicate in the circle on the coupon the number of one catalog wanted. When you have filled out a card, detach, stamp, and mail. We'll do the rest.

MACHINES AND ATTACHMENTS

1 THREADING MACHINES—*Landis Machine Co, Waynesboro, Pa.* 11-page bulletin H-45-2 describes 32C and 48C available in single or double spindle models for heavy-duty precision threading of large diameter pieces. Design features illustrated, specifications provided.

2 RED-E CENTERS—*Ready Tool Co, Bridgeport 5, Conn.* 6-page illustrated bulletin G-550-1 describes heavy-duty shank type and extra heavy-duty spindle type, designed especially for grinding work. Precision duplex, angular contact ball bearings guarantee accuracy of 0.00005 TIR. Grinding machine chart for correct selection of center taper specifications included.

● POWER BENCH PRESSES — *Waterbury Farrel Foundry & Machine Co, Waterbury, Conn.* 12-page circular 779-M-4 gives design and construction features of Series E single-acting, open-back units with speeds from 170 to 250 rpm. Work samples illustrate applications. Specifications for three sizes of low pattern and three sizes of high pattern machines. Request direct on company letterhead.

3 MACHINE COMPONENTS — *Hartford Special Machinery Co, Hartford 12, Conn.* 20-page illustrated brochure covers line including hydraulic drill units, automatic cam feed drilling units, lead-screw tapping units, multiple spindle heads, automatic index tables, and machine bases.

4 AUTOMATIC INDEX TABLES — *Cleveland Tapping Machine Co, Canton 6, Ohio.* 4-page illustrated bulletin contains construction, operational, dimensional data on positive, power-driven units available with 21 and 34-in. tables, 6, 8, or 12 stations.

5 CENTERLESS GRINDING FIXTURE—*S & E Machine Products, Bridgeport, Mich.* 4-page illustrated bulletin 109 describes unit which converts any between centers grinding machine to a centerless grinder. Adaptable to through-feed, plunge cut or form and in-feed operations. Prices, accessories, and additional parts available listed.

6 MILLING MACHINES—*Marac Machinery Corp, Yonkers, NY.* 14-page illustrated catalog contains detailed descriptions of Werner (German) units, sizes 2, 3, and 4, universal, plain, and vertical models. Specifications and accessories included.

7 THREAD-CUTTING PROCESS — *National Threading Machine Co, Paterson, NJ.* 6-page bulletin illustrates and describes Thread-O-Matic equipment for thread and worm cutting, said to cut production time 90% as compared with a lathe operation, 50% as compared with thread milling.

TOOLS AND ACCESSORIES

8 DIES—*Cleveland Tool & Die Co, Cleveland 12, Ohio.* 38-page illustrated brochure covers custom, standard, and special-purpose lamination dies; compacting dies for metal and ceramic operations. Sections on tungsten carbide fabrication; jigs and fixtures; precision gages; custom jig grinding and boring.

9 CARBIDE BURS—*Pratt & Whitney, West Hartford 1, Conn.* 4-page circular 584 gives illustrated information on Kellerflex units for small-hole finishing on internal and jig grinders.

10 GAGE BLOCKS—*Ellstrom Standards Div, Dearborn Gage Co, Dearborn, Mich.* 8-page illustrated catalog contains specifications and prices on chromium-plated blocks in 28 standard sets from 8 to 92 pieces. Available in either square or rectangular styles, with sizes in step series from 0.010 to 20.0 in.

11 GRINDING TOOL — *Continental Products, Cleveland 10, Ohio.* 4-page illustrated brochure describes Kodiak "constant diameter" grinding wheel; adjustable abrasive segments permit increasing or decreasing dia. Available in variety of sizes to fit all standard machines.

12 PROFILOMETER EQUIPMENT — *Micrometrical Mfg Co, Ann Arbor, Mich.* 12-page illustrated catalog 155 describes line for measuring surface roughness. Items include portable Amplimeter; tracers for manual and mechanical operation; motor-driven piloting equipment for straight-line, short-stroke, and circular tracing.

13 POSITIONERS—*Worthington Corp, Harrison, NJ.* 8-page illustrated bulletin R-1700-B15 outlines points to be considered in selection of units for welding,

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FOR YOUR INFORMATION

coating, surfacing, chipping, etc. Data on table rotation and tilt range, maintenance and repair, range and selection of variable speed drives, and safety features.

14 CARBIDE TOOLING, BLANKS, INSERTS—*Kennametal, Inc, Latrobe, Pa.* Catalog 55 describes complete line. Details on company's latest general purpose steel-cutting grade, K21; introduces K11, said to provide exceptionally high resistance to abrasion.

15 JIGS & FIXTURES—*Manufacturers Engineering Service, Inc, Toledo 4, Ohio.* 4-page brochure illustrates drill jigs for long or short runs; milling fixture adjustable for diameters from ⅛ to 1⅛ in. All units can be operated automatically or manually.

HEAT TREATING AND WELDING

16 DC WELDER—*Vickers Electric Div, Vickers, Inc, St Louis 3, Mo.* 4-page bulletin 7000 provides illustrated data on Controlarc Magnetic Amplifier Rectifier unit. Construction and operation features, performance charts, electrical specifications and ratings, dimensions and weights, optional accessory equipment.

17 SPOT WELDING — *Air Reduction Sales Co, Div, Air Reduction Co, New York 17, N.Y.* 12-page illustrated booklet describes Aircospot, an inert-gas-shielded tungsten-arc process of welding from one side with a portable gun. Tables, applications, operational data, standards and test procedures included.

18 HIGH-SPEED STEEL HARDENING—*Sentry Co, Foxboro, Mass.* 8-page bulletin 1077 covers Sentry Diamond Block method of atmospheric control. Explanation of recommended practice includes description of essential equipment and accessories needed, furnace operating procedure, method of loading tools, suggestions and cautions, materials customarily heated.

PLANT SERVICE EQUIPMENT

19 MOBILE FLOOR CLEANER — *Handling Devices Co, Brookline 46, Mass.* 6-page bulletin 551 illustrates and describes features and advantages of Floormobile unit for suction cleaning dust, dirt, trash, etc. from large floor areas.

● STRIPPER—*Oakite Products, Inc, New York 6, N.Y.* 6-page folder describes Rustripper, an alkaline detergent that removes paint, phosphate coatings, rust, and oil from metal surfaces in one operation. Applications listed in case histories. Request direct on company letterhead.

20 HYDRAULIC LIFT TRUCKS—*Big Joe Mfg Co, Chicago 7, Ill.* 12-page catalog M54 contains illustrated information on line, including battery-operated and manually operated units, and new Drum-toter attachment.

21 LUBRICATION PUMPS — *Trabon Engineering Corp, Cleveland 3, Ohio.* Four illustrated bulletins describe double-acting hydraulic, single-acting hydraulic, single-acting pneumatic, and cam-driven mechanical units. Cover design features, with diagrams and operating specifications.

22 MATERIALS HANDLING EQUIPMENT—*Syntron Co, Homer City, Pa.* 50-page condensed catalog 554 contains technical data, description, and pictures of vibratory equipment, feeders, conveyors, power tools, shaft seals, hammers, selenium rectifiers.

23 CRANES—*Chicago Tramrail Corp, Chicago 24, Ill.* 20-page bulletin TRC-101 describes Trak-Rak top-running or underrunning AC motor-driven units with vertical rotating column incorporating features of a fork truck. Cranes can be furnished with all motions motorized, or any combinations of push or motorized. Typical applications illustrated and described.

PARTS AND MATERIALS

24 MAGNETIC INGOT IRON FOR DC APPLICATIONS — *Armco Steel Corp, Middletown, Ohio.* 24-page illustrated manual covers magnetic core uses, mechanical and physical properties, magnetic properties, permeability, annealing practice, machining, welding, and drawing. Applications, charts, tables included.

25 HYDRAULIC & PNEUMATIC COMPONENTS — *Aircraft Products Co, Bridgeport, Pa.* 34-page bulletin 155 describes and illustrates standard line of valves: selector, restrictor, sequence, check, and shut-off. Data on hydraulic and pneumatic actuators,, spring and air-loaded accumulators, master brake control units.

26 "SIMPLIFIED STEEL TERMS & ENGINEERING DATA" — *LaSalle Steel Co, Chicago 80, Ill.* 32-page illustrated dictionary contains 180 detailed definitions ranging from annealing and austempering to stress relieving and yield strength. Curves and tables cover such subjects as method of determining hardenability, etc.

27 SMALL MOTOR SWITCHES—*Cutler-Hammer, Inc, Milwaukee 1, Wis.* 14-page illustrated booklet EC-79 describes complete line of toggle, rotary, and push-button units. Includes tables of ratings.

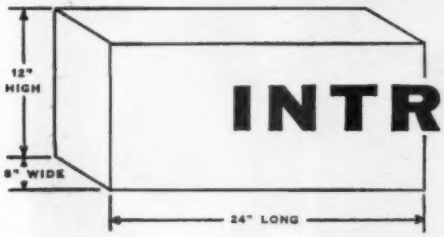
28 GEAR MANUAL — *Philadelphia Gear Works, Philadelphia 24, Pa.* 76-page illustrated catalog G-655 contains diagrams, definitions, tables, charts, information on all types, plus simplified method of calculating hp ratings.

29 HYDRAULIC CYLINDERS — *Benton Harbor Engineering Works, Benton Harbor, Mich.* 8-page folder illustrates line of automatic flow-control units for tilts, hoists, clamps, shifters.

30 "CLIPPER OIL SEAL" — *Johns-Manville, New York 16, N.Y.* 28-page illustrated manual covers selection, application, and installation of these seals. Includes description of latest LPD and RPD extruded and moulded oil slingers and end-face seals. Tables and case histories included.

31 SELF-LOCKING NUTS — *National Machine Products Co, Utica, Mich.* 24-page illustrated brochure gives engineering data, specifications, price list on one-piece, free-starting, reusable units for applications exposed to oil, water, or high temperature. Includes operational principles, applications, engineering standards, guide chart for calculating wrench torques.

32 MAGNETIC TRANSMISSION EQUIPMENT — *Stearns Magnetic, Inc, Milwaukee, Wis.* 8-page illustrated bulletin 226-D covers standard line of brakes and clutches. Includes torque requirements, service factors, descriptions, features, dimensions. Selection data and specifications of new companion line of magnetic brakes for re-rated NEMA frame sizes.



INTRODUCING... THE No. 824

Hydrabrasive super-performance now available in 8" x 24" capacity—for surface grinding jobs requiring long table length and moderate cross travel.

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Send complete details on the new Hydrabrasive No. 824 Surface Grinder.

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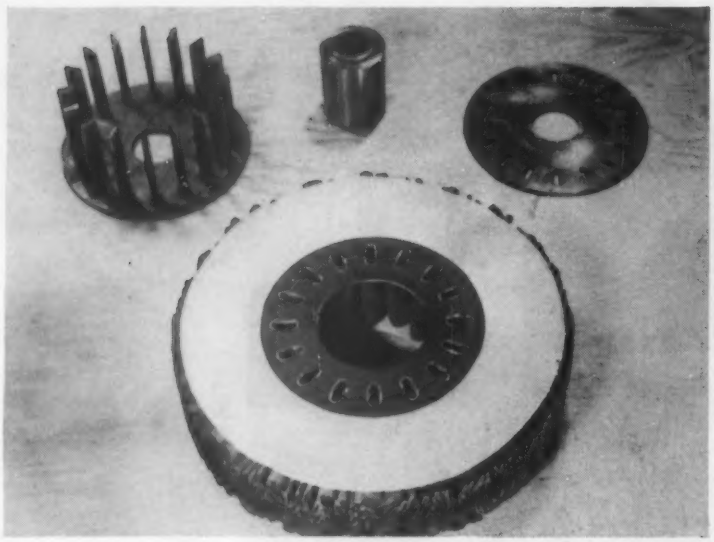
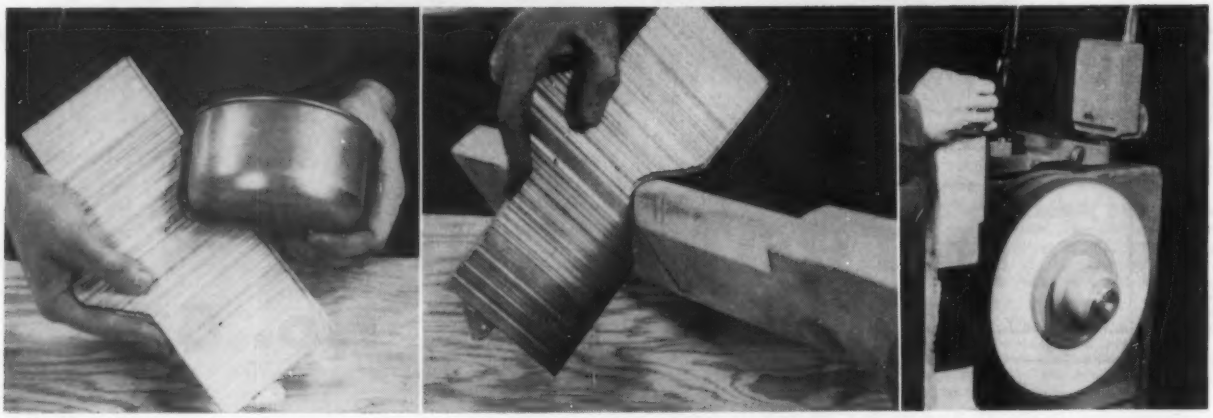


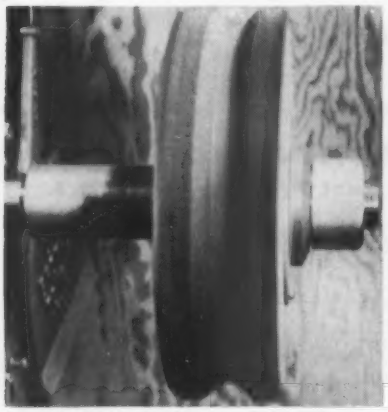
KON-TOOR WHEEL—17 in. in diameter and 2, 4, 6, or 7 in. in width—as supplied by Behr-Manning, together with three parts which fit it for mounting: (1) cage with 16 elliptical tubes which engage folded packets of coated abrasive; (2) bushing to fit drive-spindle size; (3) side plate. Canvas side shield on wheel reduces wind, noise

COATED ABRASIVE CLOTH, with grain on both sides, (grit from 120 to 400), in U-shaped packet of folded sheets. Flexibility is varied by use of single or double folds

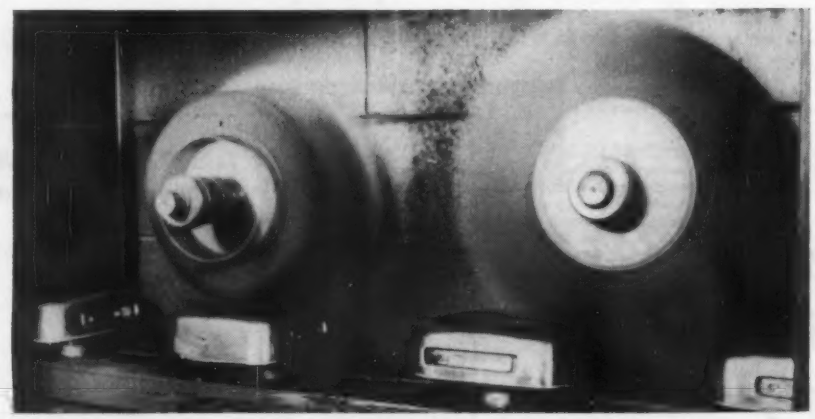
Behr-Manning Polishing Wheel Maintains Contour



PRECISE CONTOURS are achieved with profile gage as shown above for saucepan. Gage is fitted to profile, then wood block is shaped to match and coarse sandpaper fastened to block. With wheel rotating on spindle, forming block is pressed against it until wheel has achieved desired form

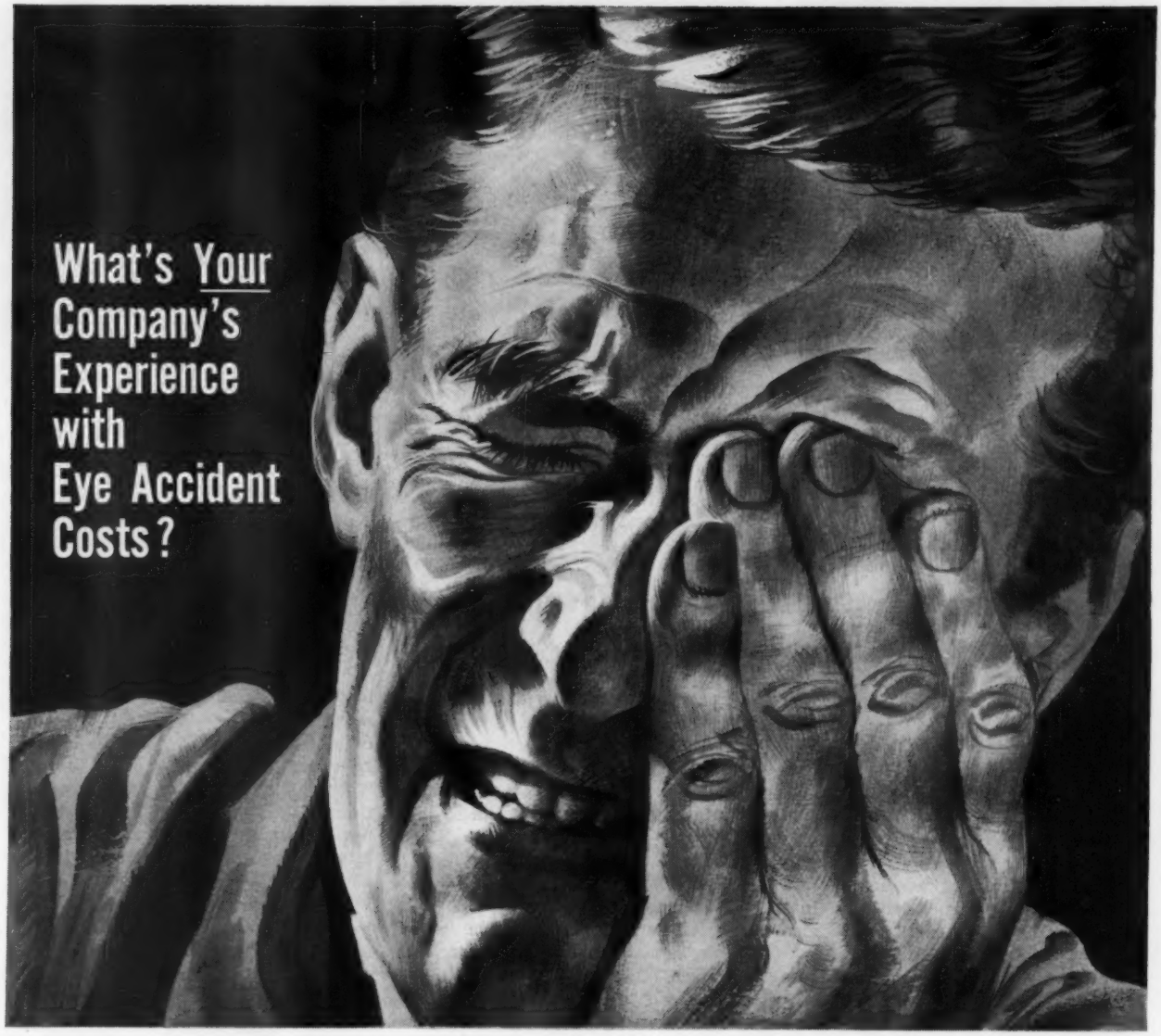


CONTOURED WHEEL ready to apply unbroken contact to work without "slapping" action



WHEELS perform at 1500 to 2400 rpm, have applied a first intermediate polish to 350,000 toaster sides. Wheel on left was originally same size, has maintained contour

Behr-Manning Div, Norton Co, Troy, NY

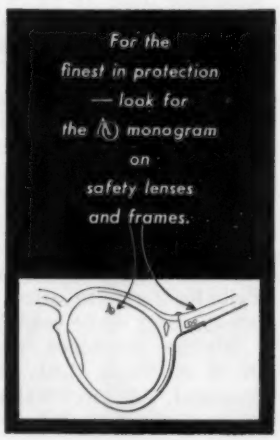


Here's a Company that has been ahead year after year...for 21 years!

Let's look at a company that has had an AO† Eye Protection Program in operation for a long time and see whether it pays over the long pull. Does the protective equipment cost almost as much as the accidents it prevents? Considerably less? How much less? These are good questions and deserve an answer.

In one of the twenty-one years, the company spent about $6,000 on eye protection but saved $20,000 on prevented eye losses. In this year, the year this company saved *the least*, it was still ahead by $14,000. In another year when the company spent about $7,000 on eye protection, it saved approximately $90,000 on prevented eye losses. Estimated savings: $83,000. OVER THE 21 YEARS, THIS COMPANY WAS SAVED ABOUT $874,000 — AND THAT'S *NET*.

You may do even better. Ask an AO Safety Representative to call. Or write American Optical Company, 5137 Vision Park, Southbridge, Massachusetts.



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SAFETY PRODUCTS DIVISION

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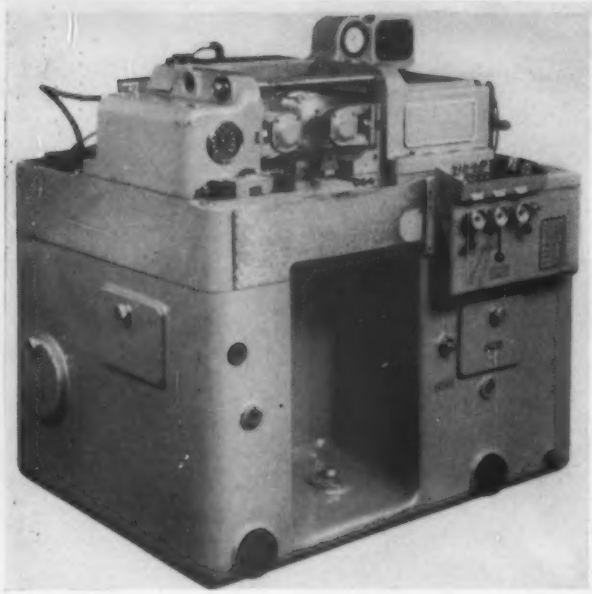
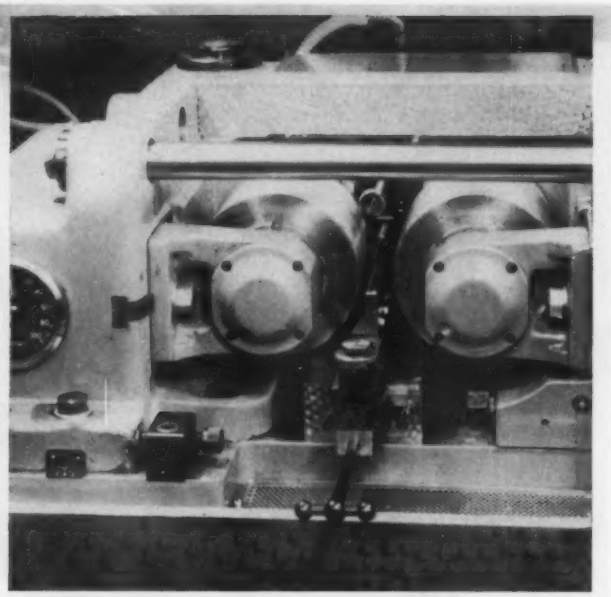
†T.M. Reg. by American Optical Company





Steinle Form Generator Rolls Gear Teeth And Acme Threads at High Speeds

To supplement the No. 1 Steinle thread roller (AM—June 7, '45), which was specifically designed to roll threads but has been adapted to other purposes, the heavier No. 3 form generator has been introduced to the American market. It will generate deep forms such as Acme and other threads up to 2-in. dia, 3 threads per inch, and involute teeth on helical gears, will also knurl, serrate, profile roll, or burnish. Capacity of the No. 3 machine is: diameters from 3/16 to 3 in., lengths up to 6 1/4 in. in plunge rolling, and unlimited length by through rolling. Materials rolled include stainless steel, alloy steels and HSS.

DESIGN PRINCIPLE

Basically, design principles are the same as smaller Steinle thread rollers, but include features found desirable from 15 years experience. Modifications adapt machine for hopper or magazine feeds, or other automation devices.

Instead of a massive overarm, the two end columns of the No. 3 machine are tied together by a tension rod at the front and a narrow overarm at the rear. Thus, a top opening is created for feeding workpieces by hand or automatically. Recess in the front of the machine is sufficiently large to allow feeding by an operator while seated.

Steinle machines are built by B S A Tools, Ltd., Birmingham, England. All electrical and hydraulic equipment is of American design or manufacture. Rolls are designed and manufactured in the United States to customer requirements for standard thread rolling and all kinds of form generation, whether standard, special or experimental.

OPERATION PRINCIPLE

Operational principle of the Steinle No. 3 form generator is akin to that of a centerless grinder. The work blank is supported by a carbide workrest slightly below the centers of the two forming rolls, but other types of workholding devices, particularly centers, can be used when needed.

All functions of the machine are infinitely variable. No change gears are used. Speed of the roll spindles is variable by means of a stepless speed drive controlled by a handwheel. Rolling pressure is variable, likewise the roll-slide advance, and timing of the dwell period to burnish the work to the desired size and finish (down to 3 mu in.). One 5-hp motor powers the spindles, another 3-hp motor the hydraulics for rolling pressure.

The rolls are mounted on spindles driven at equal speeds by sheaves and V-belts from the main motor. One spindle rotates on a stationary axis; the other is mounted in a box-type, hydraulically-operated slide. This slide has an infinitely variable feed, which is quickly set with a flow-control valve to the rolling characteristics of the workpiece. Cold flow of the metal to the desired form or thread is obtained by feeding this slide inwards at the correct rate and pressure, the latter being automatically controlled by a relief valve.

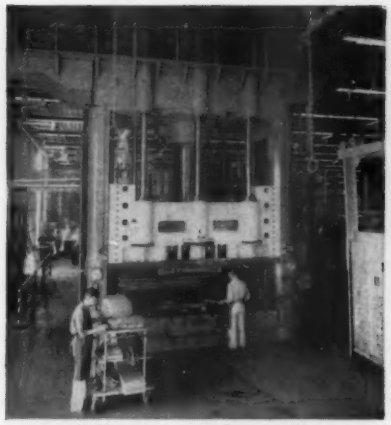
Final sizing of the part, production of the desired finish, and elimination of any ovality are obtained by a variable dwell period, which is controlled by an electronic timer. Further, the time can be varied between the start of the rolling cycle and when the rolls reach a pre-determined depth for commencement of the dwell, or finishing part of the cycle.

AUTOMATIC CONTROL

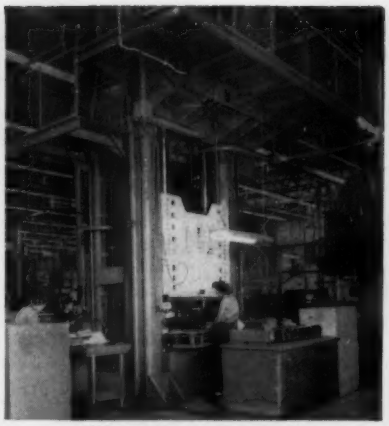
End movement of the work is unavoidable when rolling deep forms. To cause the piece to screw itself back and forth between the rolls, the pressure is automatically reduced and the rolls reversed by means of an automatic pressure-reducing and reversal control. This action is initiated by work contact with appropriate limit switches, and continues until the piece reaches final size. This is determined by contact of the roll slide with an adjustable dial stop bar.

Multiple threads (providing the pitch is within the range of the machine) and tapered threads can also be produced The stationary left-hand roll spindle is mounted in a reaction bracket that can swivel about a pivot bolt to align its roll parallel with the right-hand roll or at an angle.

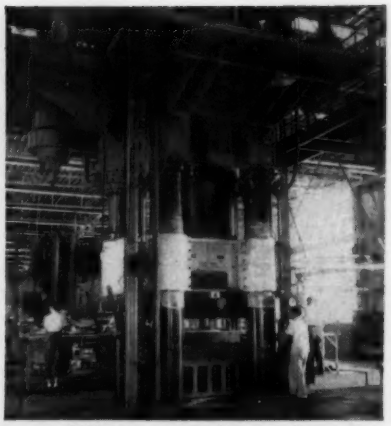
Imported by Steinle Machine Co, 172 Stanley St, New Britain, Conn



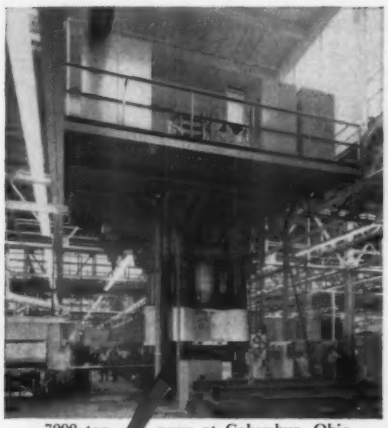
1100 ton press at Los Angeles



1000 ton press at Los Angeles

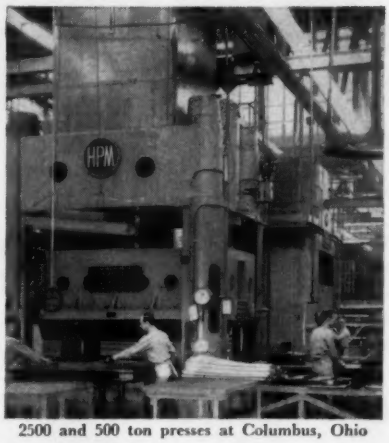


7000 ton press at Los Angeles



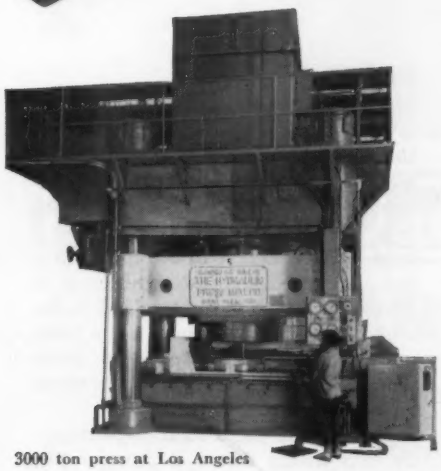
7000 ton press at Columbus, Ohio

500 ton press at Columbus, Ohio



2500 and 500 ton presses at Columbus, Ohio

Look AT THE H-P-Ms at North American Aviation, Inc.



3000 ton press at Los Angeles

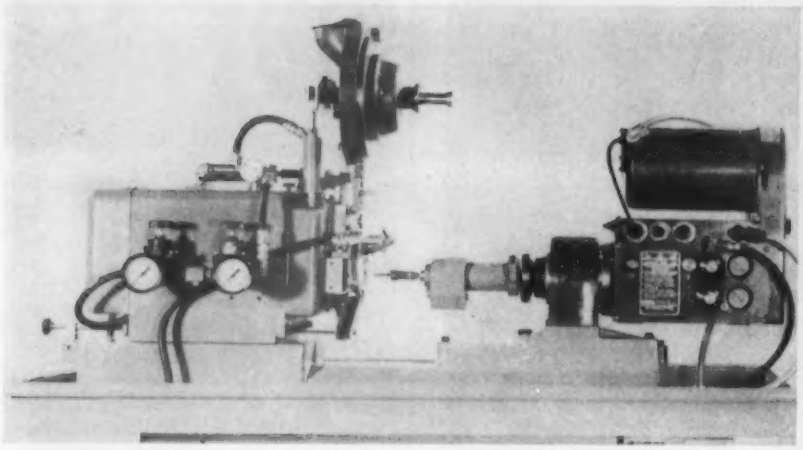
There's $2,000,000 invested in H-P-M presses at North American plants. And, they're a good investment! Why? Because big hydraulic press power, dependability and versatility are major factors in high production output in the aviation industry. These presses are being used for high-pressure rubber pad forming, die quenching, deep drawing, piercing and blanking . . . jobs where versatility must be "built-in", instantly adaptable to varying requirements and countless operations.

Yes, North American is just one of the airframe manufacturers depending on H-P-M presses to keep their production lines humming. For real unit cost reduction, plan your operation around H-P-Ms. Write for details or call in an H-P-M engineer, today.

THE HYDRAULIC PRESS MFG. COMPANY

1002 MARION ROAD, MOUNT GILEAD, OHIO, U.S.A.

HPM



Electrically Controlled Machine Drills with Compressed Air

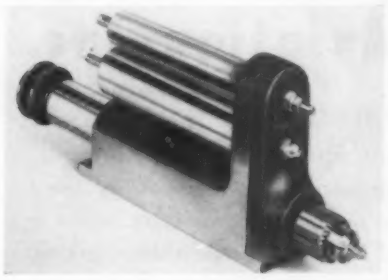
Beco No. 410 automatic drilling and tapping machine accurately locates and holds headed parts for axial tapping, or drilling to very thin walls. Tapping attachment is automatically self-reversing. Changeover from drilling to tapping is accomplished in about ten minutes. Coolant tanks are exchanged in less than two minutes.

Production in mild steel with No. 30 drill 9/32-in. deep is 40 per minute; No. 17 drill 5/32-in. deep is 45 per minute; and No. 8-32 tap 3/16-in. deep is 80 per minute.

Machine operates by electrically controlled compressed air on at least 50-psi line pressure at approximately 500 strokes per cubic foot of air. Solenoid three-way valves controlled by relays and sensitive switches regulate the cycling.

If a part is not properly positioned or the hopper runs out of parts, the machine shuts itself off. Machine is adaptable to hollow milling, centering, step drilling, counter-sinking, spot facing, and reaming.

Batchelder Engineering Co, Inc, 125 Main Street, Springfield, Vt



Precision Drilling Unit

The Lynmatic 101 precision drilling unit incorporates air-feed drilling head which includes adjustable hydraulic feed control to permit rapid traverse to the work and quick return. Unit drills do 2-in. centers and has double-row ball-thrust bearings.

Sides and bottom are machined square and parallel to the spindle to close tolerances. It is said that when unit is used in conjunction with Lynco automatic control box and cycle timer it will perform such varied operations as step drilling, peck drilling, etc., correctly drilling holes up to ¼ in.

Burklyn Co, 3429 Glendale Blvd, Los Angeles 39, Calif

New Floating Holder for Turret Lathes, Automatics

The new JS line of floating holders is reportedly the first application to screw machine and turret lathe work of the double-engagement spline-drive principle used in other Scully-Jones floating holders. A balanced, constant - velocity, flexible - drive coupling, in which the floating and driving elements are completely independent, provides unrestricted movement in floating tool into proper alignment.

In reaming, this permits tool to follow drilled or bored hole exactly. Taps and reamers are mounted in straight collet either directly or in special bushings locked in place by socket head capscrew. Through-hole in shank of holder permits stubbing tools having long shanks when using bushing in collet.

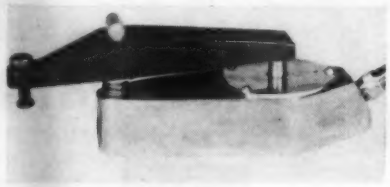
Body diameter and minimum projection of larger size holder, designed to accommodate tools having 1½-dia shanks is 3½ and 3 in. respectively. Five standard holders are now in production.

Scully-Jones & Co, 1901 South Rockwell St, Chicago 8, Ill.

Back Pressure Air Comparator

The Stur-D-Aire amplifier, a new back pressure air comparator, allows variation of the amplification to suit moderate production runs of precision parts, or instrument can be set to predetermined magnification with no change of parts. It will combine with improved techniques for salvaging air gage spindles that make unnecessary discarding or throwing away worn spindles. It is reported that any air gage spindle can be restored to new condition at fraction of new cost by Sturdy method.

Sturdy Tool and Gage Co, 14520 Schaefer Highway, Detroit 27, Mich



Jig Fixtures

The Kajon air-actuated machine dog is said to cut change time more than 50%. Termed Airmatik, it clamps work on 75 to 100-lb. line pressure through any outlet valve. At 100-lb. line pressure the clamps exert a hold-point pressure of 600 lb. Setting the clamps consists of tightening in desired position with standard ½ in. bolts. They are designed to be used with simple pin fixtures to keep work from swiveling, but work equally well with blocks.

Each clamp has a built-in pneumatic cup which forces a plunger pin up against a spring-loaded rocker arm. Holding end of each arm has adjustable screw with lock nut to accommodate any height work so that maximum hold-point pressure can be exerted. Maximum pressure occurs when arm is nearest parallel.

Burklyn Co, 3429 Glendale Blvd, Los Angeles, Calif

Want to make more money in '55

on your second operation work?

here's a tip

GET RID OF YOUR OBSOLETE HAND SCREW MACHINES

Why continue to waste money (and, what's worse, lose business to competitors) because of high shop costs due to inefficient production machines?

this NEW Wade® no. 73 HAND SCREW MACHINE

has features that give you high production... to extremely close tolerances. Some of these features are patented — exclusive with Wade.

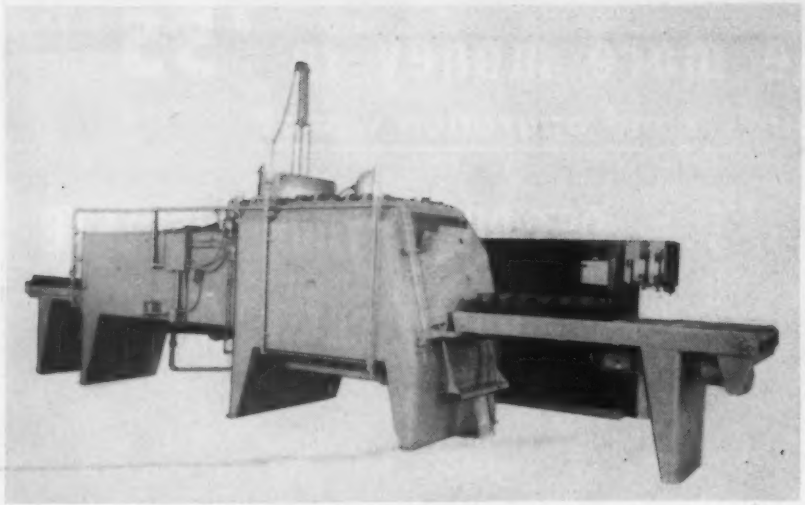
Send for descriptive circular on the **WADE NO. 73 HAND SCREW MACHINE**

Address:
53 River Street

THE WADE TOOL CO.

WALTHAM 54, MASS., U. S. A.

MAKERS OF PRECISION TOOLS FOR AMERICAN INDUSTRY



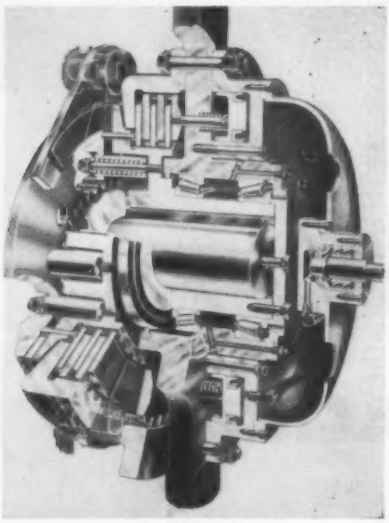
Three Heat-Treating Units With Controlled Atmosphere

Ipsen has introduced three new TFC series heat-treating units featuring multiple cooling zones for air-cooling of work under protective atmospheres. These units now make possible carburizing, carbonitriding, normalizing, annealing, stress-relieving, and brazing operations under complete atmosphere protection.

Units are classified at 400, 500, and 900 lb per hr at 1500 F. Maximum weight per charge is 600, 800 and 1400 pounds respectively. Operating temperatures are 1850 or 2150 F.

The series incorporates the time-saving straight-through processing feature. Work is loaded directly into the heating zone, and after the proper time at heat, is transferred automatically to the cooling zones by the Ipsen cold-chain transfer.

Ipsen Industries, Inc, Rockford, Ill



Clutch-Brake Combination Mounts on Press Crankshaft

A combination air friction clutch and spring-released brake announced by E W Bliss is identified as type M. It was designed for crankshaft mounting on new presses and can-making machinery, as well as for replacement of old style clutches.

Unit is of compact design, requiring only single valve for operation and control. Heating problems are practically eliminated because it does not have to start and stop back gearing—but there are built-in ventilation features. Hard linings are provided for maximum wear; no adjustments necessary. In addition, clutches and brakes are equipped with anti-friction roller bearings.

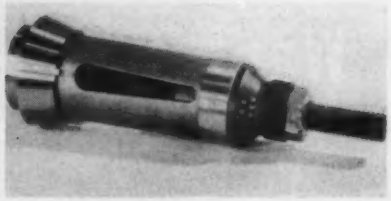
E W Bliss Co, Hastings, Mich

Heat-Treating "Painted On"

Heat-treating of steel production parts and tools which is "painted on" is announced by Armor-Tuf. Only a few minutes near the critical temperature of the steel is required under this process to obtain a hardness as high as 60 Rockwell C and a depth of 0.003 to 0.01 in. can be obtained rapidly. Greater depths can be obtained in 30 to 45 min.

This hardness and depth is obtained through the use of liquid Armor-Tuf which can be painted on gears, cams, and studs, just like cold water paint. After being dried, pieces are placed in furnace and brought up to 1400 to 1600 F.

Armor-Tuf Sales Corp, 299 Madison Ave, New York 17, NY



B&S Stock Stops

Adjustable solid stock stops and adjustable spring-ejector stock stops for use with standard Brown & Sharpe spring collets have incorporated means for attaching the stops to standard collets. Special collets with threaded ends, pins, or screws to hold the stop in place are not required. Stock stops are readily interchangeable in regular spring collets for round and hexagonal stock and are made in two styles, spring ejector and solid, eliminating additional investment in special collets.

Insertion in a collet is simple and fast; operator selects the required stop and inserts it. A partial turn raises a stock pin in the collet slot and a few additional turns lock stock securely in place.

In the adjustable spring-ejector stops, two lock nuts on the end of the spring plunger control automatic ejection of workpieces of varying lengths. Both stops are made in three sizes for use with Nos. 10, 11, and 22 spring collets.

Brown & Sharpe Mfg Co, Providence 1, RI

Pre-Anodized Aluminum Offered in Coils

Continuous lengths of pre-anodized, high purity aluminum in coils, known as Al-Kolr, are available in gold, silver, and other brilliant colors in qualities which will take stamping, piercing, forming and drawing, Continental Sunfast Products reports. Features are said to be: corrosion resistance together with high chemical resistance; extraordinary surface hardness and resistance to abrasion; good adhesive capability; high light reflection; and excellent decorative luster.

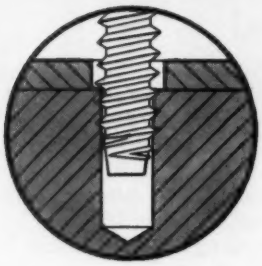
Al-Kolr eliminates necessity of anodizing finished products and serves the purpose of offering beauty and protection of those products which combine aluminum with wood, plastics, or other metals. It is available in coils of any thickness from 0.002 in. to 0.020 in., and in coil widths from a fraction of an inch to 18 in. in normal runs and up to 24 in. in special runs.

Continental Sunfast Products Inc, 1701 Broadway, New York 19, NY

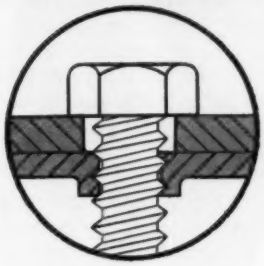
For Self-tapping Screws that...

Start Right

Drive Right



Seat Right



Millions in savings made with P-K Screws since they were originated by Parker-Kalon have proved the Self-tapping Screw *method* reduces assembly costs.

But it takes more than the right method to make sure planned savings pay off. It takes P-K quality standards to guard against defective screws that cause assembly trouble, costly damage to parts, and hidden weakness that shows up in customer complaints.

Only Parker-Kalon can offer P-K quality, the indispensable extra, along with the proved advantages of Self-tapping Screws.

Plan your assemblies for lowest cost . . . a P-K Assembly Engineer will help you. Then make sure *planned* savings *keep on paying off* . . . when you purchase, order "P-K". Parker-Kalon Division, General American Transportation Corporation, 200 Varick Street, New York 14.

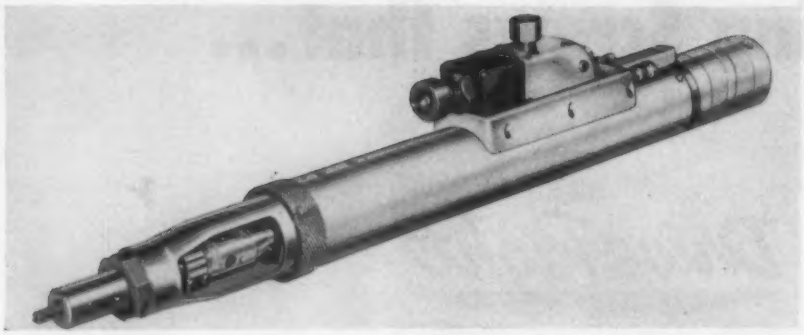
Stay Tight

PARKER-KALON®

The First **SELF-TAPPING SCREWS**

originated by P-K . . . and *first* today . . .
the leading choice for fastening economy

Remember **P-K** means **OK**



Automatic Tapping Tool

Automatic tapping tool termed Airfeedtapper features controlled thread-cutting for high-speed production of accurate threads with minimum tap breakage. The unit has adjustable torque control enabling maximum permissible torque to be delivered to tap. Adjustable feed rates permit advance to be set for best cutting with particular tap size, while return can be set for slower rate.

A micro-depth adjustment permits unit to be used for blind-hole tapping. Advance can be held within ¼ thread and tap will automatically back out when desired depth is reached. A four-way valve is used to control tool from remote station.

Forward and return poppets are built-in, making it possible to do jog tapping when working on hard metals. Tool can be run to stall and backed out by pressing return poppet. The Airfeedtapper uses standard Jacobs tapping chucks or Scully-Jones tap drivers.

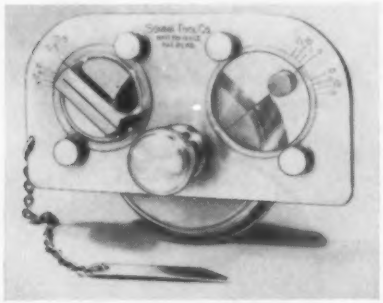
Keller Tool Div, Gardner-Denver, Grand Haven, Mich

Airline Lubricator Atomizes Oil in Remote Chamber

Gits Airliner atomizes oil in chamber remote from airline so only oil mist is injected into air stream. It is stated that this results in precisely metered particles fine enough to approach the lightness of air itself, particles which can travel much farther along the airline, with heavy particles forced to fall back into oil reservoir. Gits states that this constant, even lubrication results in maximum efficiency in oil consumption so that the airliner saves maintenance time, not only because it holds more oil, but because the oil is consumed much more slowly to acheive comparable lubrication. Each filling is reported to last 100% longer than in older-model lubricators.

Operation of the unit is monitored instantly through the large transparent dome of the mist generator. It also starts instantly, and can lubricate any volume of air from ¾ cu ft up to airline capacity.

Gits Bros Mfg Co, 1866 S Kilbourn Ave, Chicago 23, Ill



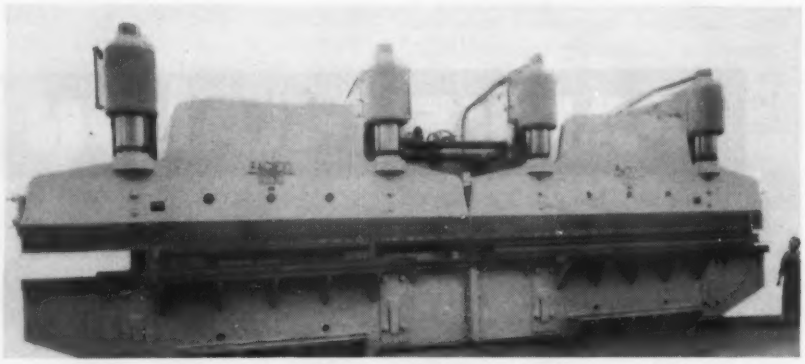
Precision Gage for Circular Form Tools

Somma has introduced a high precision gage for use in the checking and sharpening of circular form tools used on automatic screw machines. The Scribe-Chek cutting-edge gage permits exact cutting edge required on the tool with or without top rake and visual checking of the results after sharpening. Conversely, where a particular cutting angle has been established through experimentatiion, it can be measured and consistently reproduced thereafter.

The unit consists of a plate with center stud which screws into threaded hole on circular form tool. Set into the plate are two rotating dials, their centers located at the OD and offset distance of the particular size tool for which the gage is made. One of these dials is for checking and has a lens with hairline which, when lined up with graduations on the plate, indicates either left or right hand cut at any rake from zero through 15.° The other dial is for marking form tools for grinding. It is a slotted ring and its slots line up with graduations on the plate from zero to 15° left to right. It is used in connection with a blade attached to the gage which slides in the slots and is used to scribe a line for grinding on the edge of the circular form tool. The scribing dial is cut away on both sides of the center slot for maximum visibility.

The Scribe-Chek sells for $15.

The Somma Tool Co, Inc, 15 Brown St, Waterbury, Conn



HYDRALIC PRESS BRAKE, believed largest of its kind, is 44 ft long, weighs 365,000 lb., and has bending capacity of 2000 tons. The two individual 1000-ton units are electrically controlled to 0.001-in. tolerance on depth of stroke. Shown above are standard press brake dies in right-hand unit and plate-straightening dies in left—*The Pacific Industrial Mfg Co, 848 49th Ave, Oakland, Calif*

G-E Type AK-1-50 Electrically Operated Air Circuit Breaker, 1600-amperes, 600 Volts, A-C. One pole shown. Made by General Electric Company, Low Voltage Switchgear Department, 6901 Elmwood Ave., Philadelphia, Pa.

Here is the General Electric Type AK-1-50 Electrically Operated Air Circuit Breaker, 1600-ampere frame size used to protect low-voltage systems. The picture shows one pole of the contact, and in order to photograph it, the housing and the arc-quencher parts were removed. Note the Revere Extruded Shapes, and Rectangular Rod. There are three shapes, and one size of bar, all in copper, because copper has the highest electrical conductivity of all commercial metals.

If these shapes had to be "hogged" out of bar, they would be expensive, due to the machining time, and the scrap generated. While copper scrap is readily salable at good prices, it is costly from the machining standpoint. Extruded shapes by Revere, preformed to the desired contours, usually reduce machining to a cutting-off operation, plus such minor details as drilling which cannot be done during extrusion. Shapes naturally cost more per pound than bar or rod, but the ultimate saving makes up for the difference and more, sometimes several times.

Are you doing much machining of copper? If so, look into Revere Extruded Shapes. They may save money, and speed up production as well. See the nearest Revere Sales Office.

REVERE

COPPER AND BRASS INCORPORATED

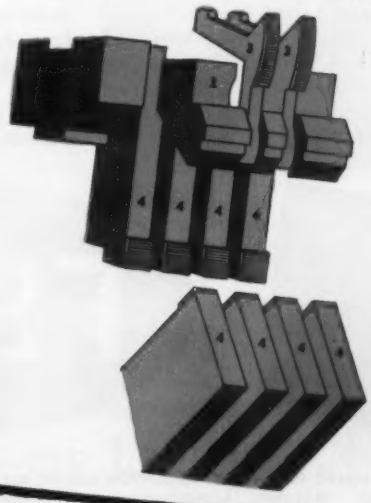
Founded by Paul Revere in 1801

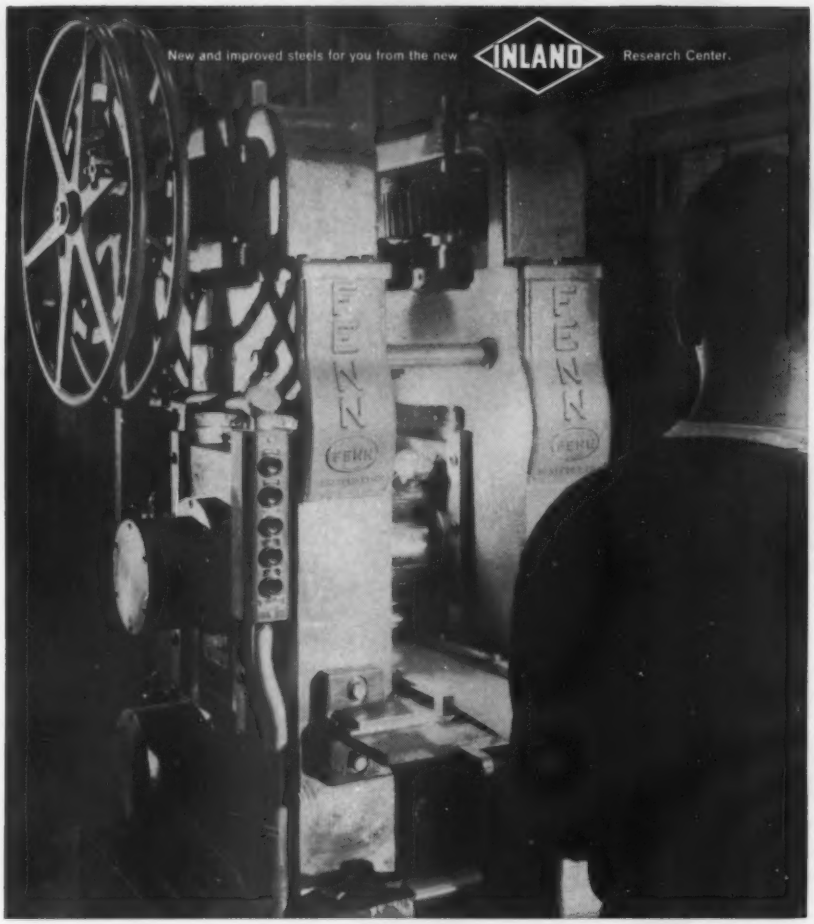
230 Park Avenue, New York 17, N. Y.

• • •

Mills: Baltimore, Md.; Chicago and Clinton, Ill.; Detroit, Mich.; Los Angeles and Riverside, Calif.; New Bedford, Mass.; Rome, N. Y. —Sales Offices in Principal Cities, Distributors Everywhere

Sketch showing details of contacts. Nos. 1, 2 and 3 are extruded and drawn copper shapes. No. 4 is rectangular copper bar. Cross hatching represents special arcing contacts brazed to the copper.





THIS PINT-SIZE ROLLING MILL MAY SAVE YOU KING-SIZE HEADACHES (AND MONEY TOO!)

At Inland, 'new ideas' are considered as vital a raw material in steelmaking as top grade iron ore and coal. Establishing reserves of this basic ingredient is a continuing job for Inland's research and development people. The new Inland Research Center in Hammond, Indiana, where Inland researchers look for better steels and more efficient ways to make them, is the most recent addition to Inland's 'new idea' resources.

We at Fenn are pleased to quote the foregoing from a recent advertisement of Inland Steel Company of Chicago. We are especially glad that Inland found, in Fenn rolling mills, the precision, flexibility and rugged dependability demanded in their research projects.

Fenn will design rolling mills for all special applications, in a complete range of sizes, and will furnish all accessories. Fenn mills have extra bearing capacity to take higher horsepowers, and are designed for year-after-year accuracy —owning cost is exceptionally low.

FENN

PRECISION ROLLING MILLS—TURKS HEADS—WIRE SHAPING MILLS—SWAGING MACHINES—ACCESSORIES

The Fenn Manufacturing Company, 757 Fenn Road, Newington, Connecticut

ROUND TABLE Discussion

SLIDE-RULE FOREMAN

Does the engineer, appointed shop foreman, have a strike against him in the men's eyes? Will they resent the fact that he hasn't worked up from the ranks? Can he make a good foreman?

THE CLASSIC DEBATE between the practical man and the academician is certainly not new. An eloquent exposition on the subject may be found in the preface of the book "Steam and Gas Turbines;" A Stodola, translation by L C Loewenstein; McGraw-Hill Co; 1927. A small excerpt is given:

"To be sure, much can be achieved by purely empirical methods; a naturally highly gifted 'practical man' will be able to work more effectively than an inexperienced 'theoretician.' But it must not be forgotten what high price had to be paid for progress based on 'experience' alone. The initiate well know how certain manufacturers ran into a rut and fell out of the running because they had too long resisted using the better methods of modern development. The inveterate empiricist usually hides his embarrassment by contempt of everything scientific and of its representatives. Upon the other hand, we must guard against looking upon theory as the only cure-all of the manufacturers' difficulties. Reality is too complicated for us to be able to take account of

"To be a successful foreman, son, you must have the respect of your men! They must look up to you!

the ramifications of the innumerable acting causes and to control them scientifically."

The fact which both factions seem to forget is that all are working for the same entity, instead of considering themselves as autonomous units above reproach and mistakes. Because the engineer considers his livelihood a profession while the mechanic considers his livelihood a trade, should not form the basis for casting aspersions upon each other.

I have had the good fortune and opportunity to serve a four-year apprenticeship in the machine shop of a US Naval shipyard and to attend five years of engineering college at the University of California.

I have found that much more intense concentration, mental effort, longer hours of study are required in school. These qualities are also required of the shop foreman. The training accorded engineers is more than just measured amounts of mathematics, physics, mechanics, and the related sciences; rather, the engineer is inculcated in the systematic, logical, and analytic method of thinking. Of necessity, in four or five years of college the engineer can learn only the fundamentals. To attain any degree of sophistry requires work experience. Work experience cannot be gained in school.

To suggest absolute statements as to whether engineers can make good foremen or not is to oversimplify the problem. Much depends upon the engineer's ability, intelligence, and resourcefulness. Mediocrity may be found in any trade or profession. The engineer without the benefit of shop experience may make a good foreman if he is intelligent, willing to learn, and able to reason in a systematic, logical, and analytic manner. In the final analysis, a competent engineer with native intelligence can assume the duties of a shop foreman.

S Y Lee
San Francisco, Calif

•

BLUEPRINT FOR ERROR

If errors in production can be traced to bad blueprints, should the blame rest on Engineering, or on the worker who tries to interpret the poor prints? Is there any line at which prints should be returned for illegibility?

ILLEGIBLE and puzzling drawings are indeed a problem in the average manufacturing plant since no two persons appear to be in agreement as to what a drawing should convey and how it should convey it. Al-

ONLY

GOSS and DeLEEUW AUTOMATIC CHUCKERS offer the 1-2-3 feature

This NEW development—unsurpassed for speed, convenience of tooling and precise finish—involves no retooling problem even for short runs. It assures greater production at lower cost on all classes of work.

The unique "1-2-3" feature, exclusive with Goss & De Leeuw, provides the means for performing one to three right or left hand single or double threading operations simultaneously or in sequence, without changing set up.

Here's an ideal machine tool for small lot requirements because of quick, easy changeover. Any class of chuck work can be handled economically in any quantity.

The examples of work shown here are typical of the wide variety of parts being produced on these new machines.

SEND FOR detailed information on this new machine. Let us have samples of your work in order to give you time and cost estimates for handling it on the "1-2-3" Goss & De Leeuw.

GOSS & DeLEEUW
QUALITY PRODUCT-QUANTITY

GOSS and DE LEEUW MACHINE COMPANY, KENSINGTON, CONN., U.S.A.

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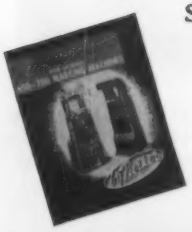

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though standard drawing practice is laid down both by the ASA and by the British counterpart, the standards are merely suggestions and appear to have very little force in the industry generally. It is interesting to note that in the case of the recently introduced British Standard Specification on drawing practice, the firms who were represented on the committee do not adopt the recommendations of the standard in their own organizations.

Both the British and American standards on drawing practice are sound in principle and they should be adopted by every possible manufacturing firm who has to make drawings. Under present conditions, every chief designer or engineer has his own pet theories about drawing practice and the result is complete confusion; every man in charge of a drawing office can deviate from standard practice because he has a pet prejudice against some part or other of the standard as it is laid down. He therefore makes his design team produce drawings incorporating his own prejudices.

On the other hand, if this same chief engineer were compiling a written report, he would use standard English and would, very likely, lay out the report in a standardized way. When making both engineering drawings and writing reports, he is performing the one function of imparting information. He should be imparting information to some other person who understands the same language, but in drawings, the reader usually has to query some point or other.

There is no necessity for this multiplicity of drawing practices. For once, the chief designer or engineer should be over-ridden and forced to

"You wouldn't really fire me. You're just saying that to make me feel good!"

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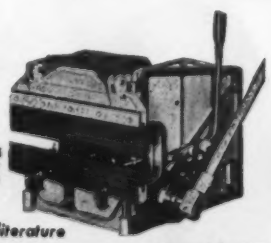

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adopt the national standard practice laid down, and no arguments should be permitted. Engineering managements and employers' organizations should set a firm line and insist that chief engineers cease playing around with fancy systems of their own.

It is true, there may be defects in the standard; it is impossible to produce a standard suitable to all, but a poor standard is better than none at all. Standards are often produced by technical committees having a hundred or more members. The chief engineer who claims that his ideas on the subject are better than the committee's should be taken down a peg and made to toe the line.

If workers make mistakes through bad drawings and prints, then the blame rests squarely on the drawing office. They make the tracings from which the prints are made, and you can't get a strong print from a weak tracing.

I am perpetually astonished at the faint and smudgy prints with which some men have to work. The pencil tracing is now universally used, particularly for tool drawings and short run jobs. No one wants to insist that the ink tracing be adopted universally, but the possibilities of error arising in ink tracings are much less than with pencil. With ink, the line is dense or non-existent, there can be no intermediate tones. With pencil, the lines can vary between jet black and pale grey. The density of the pencil line is dependent on the draftsman. If the pencil grade is right for the paper, he can get a dense line by going over it twice. If he is lazy, he will go over the line once only, and a faint print will be produced.

Far too many firms are using the wrong printing methods and papers for their shop prints. The best judges

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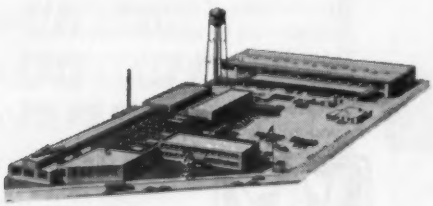

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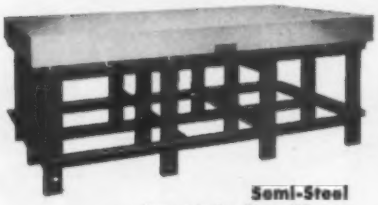

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as to the readability of prints are the men who have to work from them. The drawing office is not competent to judge because if a query is raised about a dimension or other item, they will consult the tracing. Many draftsmen never see a print from one of their tracings; it is obvious that they should.

Getting shop complaints back to the general office is the job of the shop foreman. In many firms he has direct access to the draftsman who made the tracing. If the shop drawings are consistently bad, the best way I know of bringing the defects to the right place is to use the suggestion box. A suggestion that the legibility of prints be improved is surely conducive to increased production and reduction of scrap.

Clifford T Bower
London, England

IF THE PRINTS are in good condition, not torn, badly creased, or shop-soiled, and the figures and letters—or some of them—are not distinct and clear, the fault can generally be laid at the door of the drawing office responsible for the origin of the print concerned. If those conditions prevail, it is evident that the offending print left the drawing office in an unsatisfactory condition, overlooked by the checker, or that the checker was careless, incompetent, or plain lazy.

If we may judge from Al's complaint "You know, we really ought to have some way of getting back at engineering for the sloppy prints they give us—among other things that aren't right," accurate drafting and checking are not the strong suit of engineering. On the other hand, if the drawing has been carelessly handled in the shops, badly smudged, torn, crumpled or creased, the clear-

"Wives are lucky. Machines are doing all the work for them automatically."

Which

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of these

STEP DRILL

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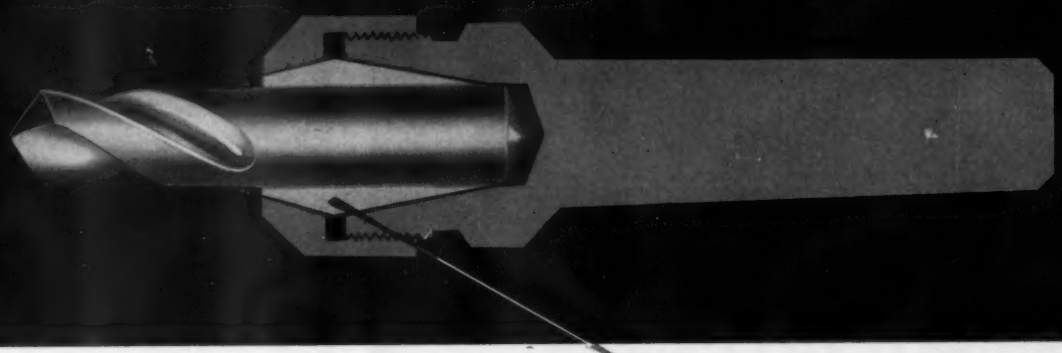
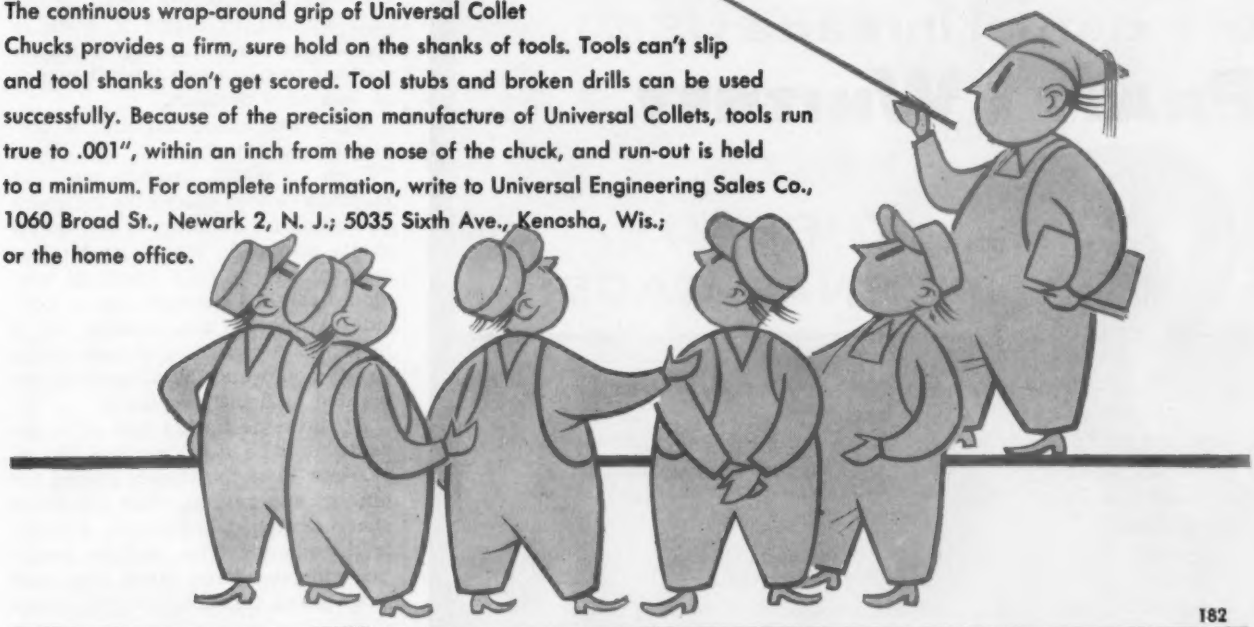


The continuous wrap-around grip of Universal Collet Chucks provides a firm, sure hold on the shanks of tools. Tools can't slip and tool shanks don't get scored. Tool stubs and broken drills can be used successfully. Because of the precision manufacture of Universal Collets, tools run true to .001", within an inch from the nose of the chuck, and run-out is held to a minimum. For complete information, write to Universal Engineering Sales Co., 1060 Broad St., Newark 2, N. J.; 5035 Sixth Ave., Kenosha, Wis.; or the home office.



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est of figuring and lettering on a new print can become suspect in the "as used" condition.

In this latter case, no man with a real interest in his work would take it upon himself to make a decision if there was a doubt about the value of any figure or symbol. The machinist who did so would indeed be responsible for the resultant scrap and would be asking for a swift reprimand. It is not for him to decide if the foreman is too busy to be bothered with such detail. Why should the foreman be too busy? That's his job, to make decisions, not the machinist's.

My experience is that men on the tools are never anxious to assume responsibilities that should, properly, devolve on the foreman, and that is all to the good. That is an attitude of mind which every good foreman should encourage in his men. If a foreman shows annoyance at being consulted in matters of detail, he has only himself to blame if work is spoiled by well-meaning workmen wishing to spare him the annoyance of making a decision.

If Al had made a point of frequently impressing on his men "When in doubt, consult me," he might have been spared the indignity of looking for an out over two dozen shafts scrapped. Machinist Mullins may, of course, be a know-all who would think it beneath him to consult Al about the reading of a drawing. A repetition of such costly vanity could only be adequately rewarded by firing the culprit.

At the same time, I feel all is not as it should be in Al's section. To me, it seems to be too loosely geared for efficient supervision. Why two dozen shafts scrapped before the mistake is discovered? The mistake would be understandable were only one shaft going through, but two dozen

"Sports Editor? In what round at Toledo did Dempsey knock out Willard?"

is a different matter. A very simple system of "in operation" examination would have uncovered the blunder in the early stages. In a well organized shop it would have been spotted at the finish of the first shaft. Al's anxiety to find an out is understandable.

The shop should refuse every print that isn't comfortably big in its drawn figures and numerals, isn't as easy to read as, say, the American Machinist, and isn't crystal clear as to the meaning of all symbols. It should refuse them by clearly setting out in a duplicate note the reasons for refusal and if the shop is overruled in the matter, responsibility for shop mistakes arising from the drawing defects complained about must be accepted by the person who overruled the shop complaint.

The foreman should see and study every new drawing coming to his shop; only thus will he get a real grip on the work. He must not, however, be expected to check each new drawing for accuracy. The foreman's study of new drawings should be directed to making himself familiar with the new work as a whole and to satisfy him on points of legibility and clarity.

Too many draftsmen take too much for granted and too many chiefs aid and abet them, not to mention checkers. It cannot be too often stressed that, normally, a tracing is made only once. Dozens of prints may be taken from the one tracing and those prints may be used by dozens of men in the shops. The tracing is, therefore, the master, and all concerned with engineering know what happens to production if a master is in fact, not a master. Design work cannot be executed on piecework and if urgency compels rush, scrutiny, step by step and detail by detail, should be re-doubled; the scrutiny should include clarity and legibility. A day extra spent on making a drawing can save weeks in the shops.

Saving paper in the drawing office, at the expense of clarity and sequence numbering of drawn details, is pantomime economy. It is not uncommon to find a sheet with forty or fifty details drawn to abnormally small scale, matched with microscopic-dimension figures, to read the which, a magnifying glass must needs be used. Symbols for quality of machining, fits, etc, differ from company to company and should definitely be standardized. It is all so stupid and confusing, resulting in so many mistakes and wasted time in the shops, to say nothing of the amount of bad temper generated.

Foremen or assistants have not the

For a
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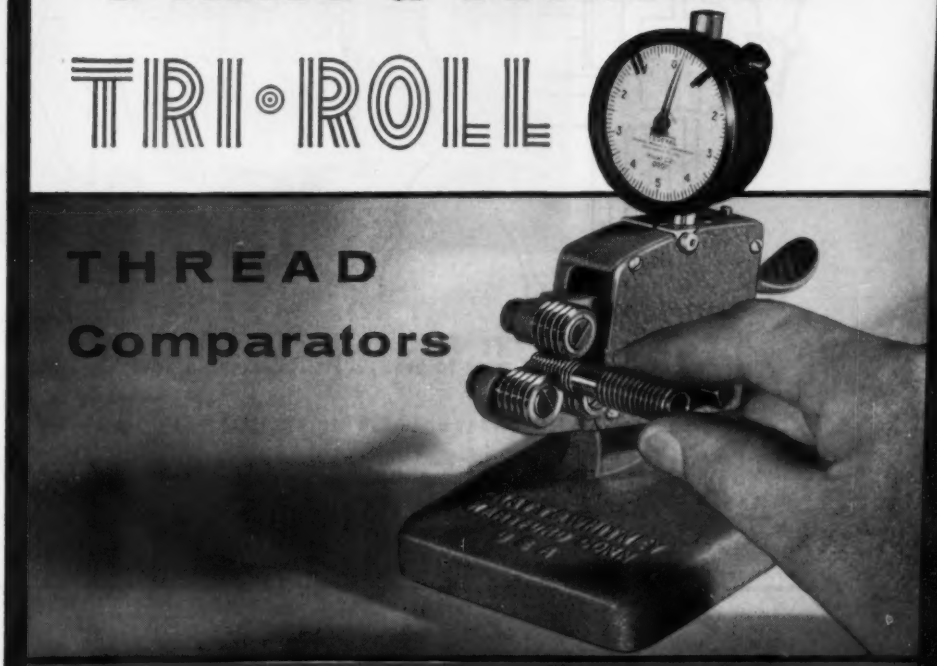

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time to individually coach every man in the art of deciphering sloppy drawings. All shop drawings should be clear, plain, easily understood, and generously spaced, so that the slowest and least intelligent of the operators can readily understand them. No drawing should reach the shops if it does not fulfill these conditions. Those are the defects the good foreman should look for in new drawings; their presence should lead to instant rejection.

C Donald-Mackinnon
Glasgow, Scotland

THEORETICALLY, the engineering department is responsible for seeing that the shops get legible blueprints. In some plants, and in some cases this responsibility works out. In a large proportion of cases and in most plants, many illegible drawings and prints do reach the shops and do cause endless delay and confusion.

The greatest cause of illegible drawings is a result of progress—the elimination of tracing and inking operations and the invention of the ozalid process. Add to the ozalid process the tendency of modern draftsmen to use 4H and 6H pencils, and you have an impossible situation. I have wished many times that hard pencils had never been invented.

The illegible drawing situation has reached the point where it really needs national attention. In self defense, I have found it practical and expedient in the past to route all shop drawings and prints through the hands of one carefully picked and elaborately coached individual in the planning department. This man has had instructions to send back illegible prints and secure legible copies. This practice puts all the responsibility for legible drawings on one man, and the system works out well.

Not being an ozalid operator, I wouldn't know whether poor prints

(Continued on page 190)

"Mister Pinchley? About that raise you gave me . . . ."

Welded pipe joint being radiographed with isotope camera using iridium 192.

It's piping with problems—

so every joint is welded—and

RADIOGRAPHED

THIS UNIT of a piping system is headed for duty never faced by piping before. High pressure? Yes. High temperature? Yes.

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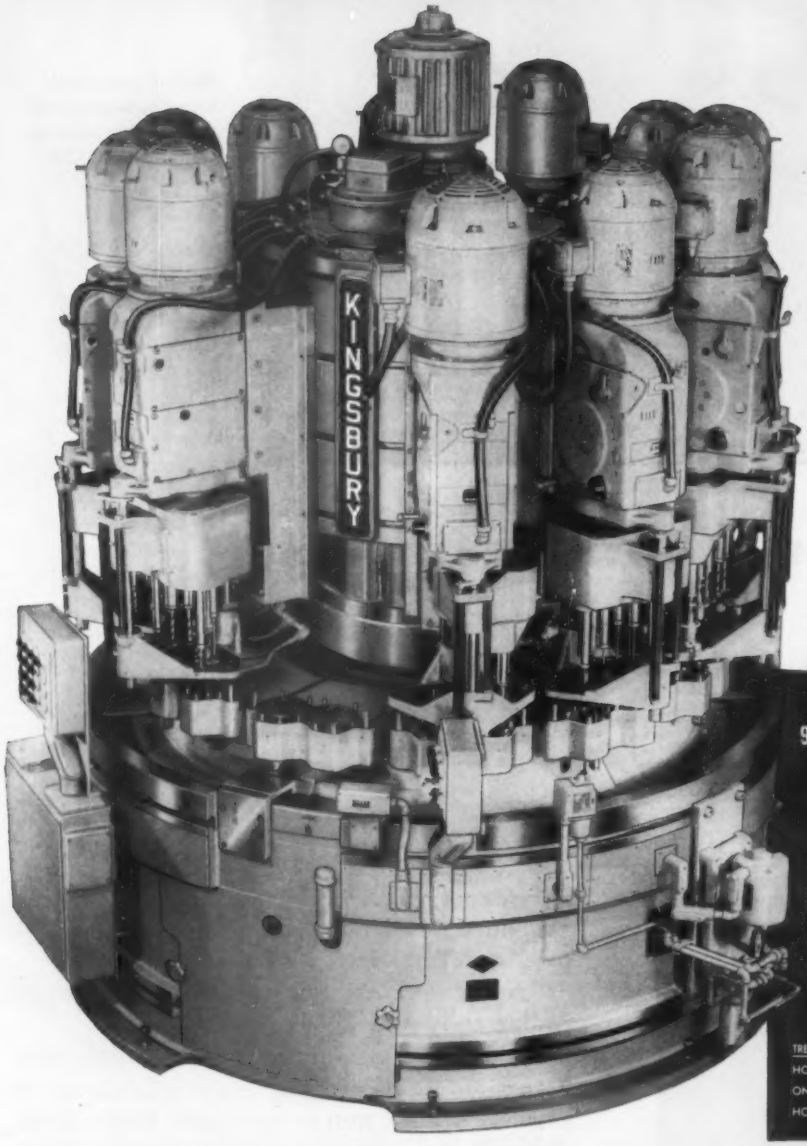
"Operations Kingsbury" in these two machines



Floor space occupied by each of these Kingsburys has an extremely high production ratio. Here's the story in table form:

Part	Number of Operations	Number of Work Units	Average Sq. Ft. per Unit	Parts per Hour Gross
Valve Plate	91	11	10.0	450
Venturi Cluster	12	12	9.7	600

Steel plate valve featured here measures approximately 5 3/8 inches diameter and 5/32 inch thick. It has 23 holes, 10 of which are previously pierced. Print called for seven basic operations as shown in the blueprint and in Table 1 below. Production output is 360 pieces per hour at 80% efficiency. This is an average of one finished piece every 10 seconds. And since there are

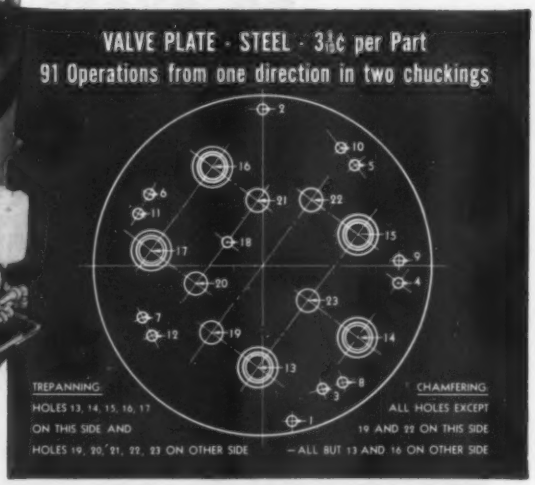

VALVE PLATE · STEEL · 3 1/16¢ per Part
91 Operations from one direction in two chuckings
TREPANNING
HOLES 13, 14, 15, 16, 17
ON THIS SIDE AND
HOLES 19, 20, 21, 22, 23 ON OTHER SIDE
CHAMFERING
ALL HOLES EXCEPT
19 AND 22 ON THIS SIDE
— ALL BUT 13 AND 16 ON OTHER SIDE

TABLE 1 91 OPERATIONS	HOLES — 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
FIRST CHUCKING, FACE SHOWN	MACHINE STATION NUMBERS																						
Drill *10 holes pierced	1	1						4	4	4	4	4	*	*	*	*	*	4	*	*	*	*	*
Chamfer	10	10	3	3	3	3	3	5	5	5	5	5	8	8	8	8	8	10		1	1		1
Tap Drill			2	2	2	2	2																
Ream													6	6	6	6	6						
Trepan													7	7	7	7	7						
Chamfer from rear													9			9							
SECOND CHUCKING, PART TURNED OVER	MACHINE STATION NUMBER																						
Chamfer	10	10	2	2	2	2	2	3	3	3	3	3		6	6		6	5	6	8	6	8	8
Tap			11	11	11	11	11																
Ream	1	1						4	4	4	4	4							1	10	10	1	10
Trepan																			5	7	7	5	7
Chamfer from rear																			9			9	
TOTAL OPERATIONS	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	3	4	4	4	4	4

develop more production in less floor space

91 operations on each piece . . . well, you figure it!

Kingsbury machine has an 81 inch circular base. All spindles are vertical. Units are mounted on a central column, and are located at the periphery of the 60 inch Index Table. This table indexes through 12 stations, one for loading and unloading.

Each part is run through the machine twice. Twin work-holder fixtures present two parts at each work station, where multiple spindles operate the tools.

* * *

You could palm this die casting and do *magic* with it! In fact, considerable "magic" was evidenced in the die, where straight and tapered holes were formed. Our job was to build an automatic machine to drill and finish holes at angles. That's easy enough! But the customer wanted an average production output of 480 finished pieces per hour — and that's *good* magic!

Production output of 480 pieces is 80% of 600 pieces per hour gross, or one every six seconds! Since each piece requires six basic operations, it was necessary to reduce the time for each operation to the minimum cycle consistent with required accuracy.

In Table 2 you will note that Holes BB-1 and CC-1 are each drilled in two stages. The burr-reaming operations at two other stations also form the bell-mouths.

Machine has a 96 inch base on which 12 work units are mounted, numbered 2 through 13. Index Table is 30 inches diameter and has 15 work-holding fixtures. Table indexes through 15 stations. Station 15 is for loading and unloading.

* * *

Each Kingsbury is specially designed and custom-built to provide the highest practicable production—at costs which should enable you to write off the capital investment in three years or less. If you have a high production job that's *right* for a Kingsbury, let's get together.

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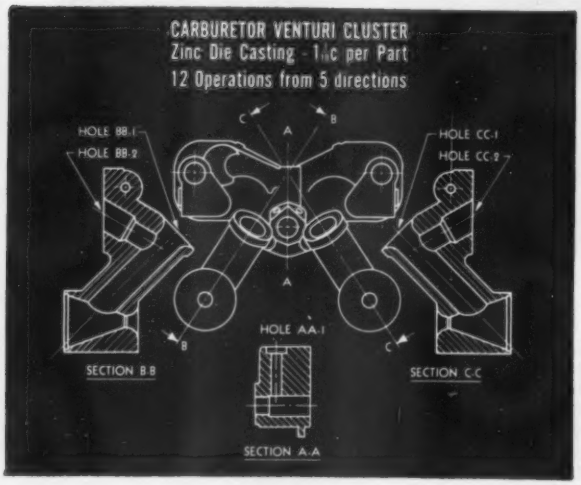

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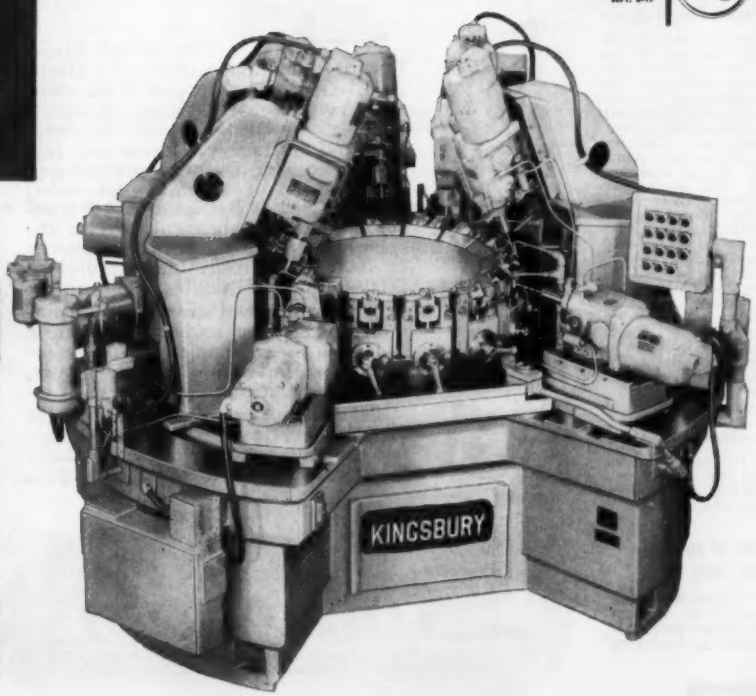

TABLE 2 BASIC OPERATIONS	Section Holes Numbered				
	AA-1	BB-1	BB-2	CC-1	CC-2
	Machine Station Numbers				
Drill	7-A	2-HR 4-HR	3-AR	9-HL 11-HL	10-AL
Step Drill			3-AR		10-AL
C'bore	8-A				
Burr ream		6-HR		13-HL	
Ream			5-AR		12-AL
Chamfer			3-AR		10-AL
WORK PER HOLE	2	3	4	3	4

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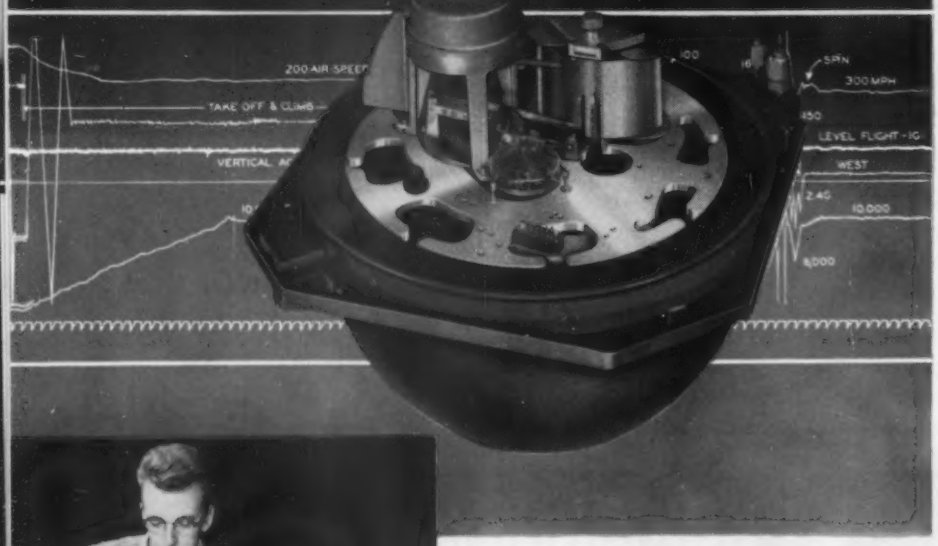

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15 Different Operations —

The sphere, protecting the delicate sensing instruments, is completely fabricated by Spincraft. The sphere consists of an outer steel and inner aluminum shell separated by insulating material. The two hemispheres are joined together by an ingenious locking and sealing arrangement. Spincraft's complete fabricating responsibility involved spinning, machining, arc-welding, spot welding, brazing, grinding, sawing, drilling, braking, stamping, phosphate plating, anodizing, painting, assembly and pressure testing. Craftsman (above) is shown assembling a Flight Recorder.

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are due to poorly treated paper, unskilled operators, worn-out lights—or what. I do know that a large proportion of prints from any ozalid machine are too light, too dark, murky, obscure, and unreadable for some reason or another. This condition exists even when the machine is being operated by an alleged expert. Once, I worked for over four months on one such print and ended up in a hospital with a badly infected eye which specialists barely succeeded in saving.

A machine can't make a clear print from a faint, illegible original, and that brings us back to the drawing rooms. When I was in college, they taught me to use a 2H pencil for center and construction lines, and an HB for the outlines of the figure. A drawing made with those pencils can be depended on to turn out a legible print.

Today there is a thoroughly vicious practice among alleged draftsmen and designers of using 6H and 4H pencils exclusively. I wouldn't know who fathered this pernicious and reprehensible practice, but I do hope his demise will not be unhurried, and I can be counted on for a chaste wreath when the happy event takes place.

There was a time when the chief draftsman and the chief engineer were responsible for the accuracy and clearness of the drawings made under their supervision and even for the legibility of the prints from which the rest of us were to work. Today, most of the chief engineers I know are so busy interviewing and being entertained by expense-happy salesmen that they have no time to know what is turned out in their departments, let alone to check prints. I would say the gap between a chief engineer and a working drawing re-

"Are you the new welder?"

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sembles the space between Malenkoff's true thoughts and Christ's Sermon on the Mount. I fear that while once a chief engineer made good prints for making more and better products, today he makes more salesmen for bigger lunches and better ball games; and if you think it isn't true—you just don't know present chief engineers.

James K Matter
Detroit, Mich

I WOULD SAY, with regard to fixing the blame for spoiled work due to an illegible print, that the human element was solely responsible. To be more explicit, no print should be issued from the engineering department that does not convey its meaning simply, clearly, and accurately. So, first and foremost, engineering was the prime culprit. Then, in order of culpability, the foreman—always in the middle, of course—and lastly the workman. The foreman should have seen the print before giving it to the man, and checked with engineering on the disputed dimension. Lastly, the machinist took a chance, instead of checking with his foreman. The old maxim that says "Be sure you're right—then go right ahead," may be trite, but it packs a lot of truth!

Having fixed the blame, obviously the next thing to do is eliminate, so far as humanly possible, the factors that make errors possible. The individual who makes the final check on the print in question maybe didn't make as close a scrutiny as he should have. If a ruling was made whereby every foreman had to sign a release with engineering every time a new print was issued to his particular department, he would be mighty careful in checking it for legibility before he sent it on the job. This method of checking the checker might throw a little extra work on the foreman, but it would save money in spoiled work, not to mention the ruffled feelings that ensue when a boner of this type occurs.

Incidentally, I cannot for the life of me see why a design engineer or the head of an engineering department should be so hard to talk to as Ed and Al make out. There is nothing hallowed about a drafting room, and engineers are prone to error even as you and I. There is no reason on earth why people who earn a living by working for the same company should not cooperate to make that living easier and the company more profitable.

I recall several years ago working in the machine shop of a good sized steel and wire mill. I used to see an old gentleman — probably around sixty—which seemed old to me then, who spent quite a lot of time in the shop and the foreman's office.

He would stop and chat with the men at the machines, and would wander around wearing an old coat sweater, chewing tobacco. Being new on the job and curious, I asked one of the boys who he was. "Why, that's old Lonnie, the head draftsman. He designed most of the equipment around the mill. He hangs around the shop quite a lot—nice old guy. You'll get to know him!"

I did get to know him and found him all that the boys said he was, courteous and always interested in what you were doing, and not above explaining the why and wherefore of a piece of equipment. He and the foreman got along together famously. If the foreman thought a tolerance was too close, or a blueprint didn't seem to tell the full story, a telephone call would bring him and Lonnie together and in no time at all everything was taken care of to their mutual satisfaction. No fuss, no wrangling, and no complaints to foremen's meetings.

If there is a moral to this it should be that democracy is just as important in industry as anywhere else. Any company that allows certain of its employees the luxury of feeling superior is headed for a fall.

Robert S Alexander
Glastonbury, Conn

"Would you like some soup, John?"

WHEN AN employee looks at his paycheck and because of a blur doesn't know what the correct amount is, he really gets in high gear to find out. This same employee, when glancing over a blueprint and coming across an illegible dimension, will try to figure out what it should be. He doesn't want the boss to think he is a dope and can't read a simple blue-

print just because there is a blob of grease or an erasure made by the draftsman.

If a worker looks over a blueprint and finds that it is not clear, he should immediately turn it back to the foreman. The foreman should bring it directly to the engineering department and demand a clearer print. The person in charge of drawings should immediately take care of his request—and it's as simple as that.

If the chap in the engineering department gives the foreman a hard time, the latter should take the print and shove it down the engineering department clerk's throat.

Any job turned out of the shop that is in error due to an illegible print is the responsibility of the shop foreman. The big squawk that comes from the shop about poor drawings is when someone in the shop goofed and is trying to find an out. The boys in engineering are a good lot and are very cooperative. They know that they are a service department and in order to keep their job, have to give service. They might be rushed at times and let a bad drawing get through, but generally they are proud of their work. You will notice in the title box that each draftsman signs his initials. He wouldn't want his initials to appear on an inferior piece of work.

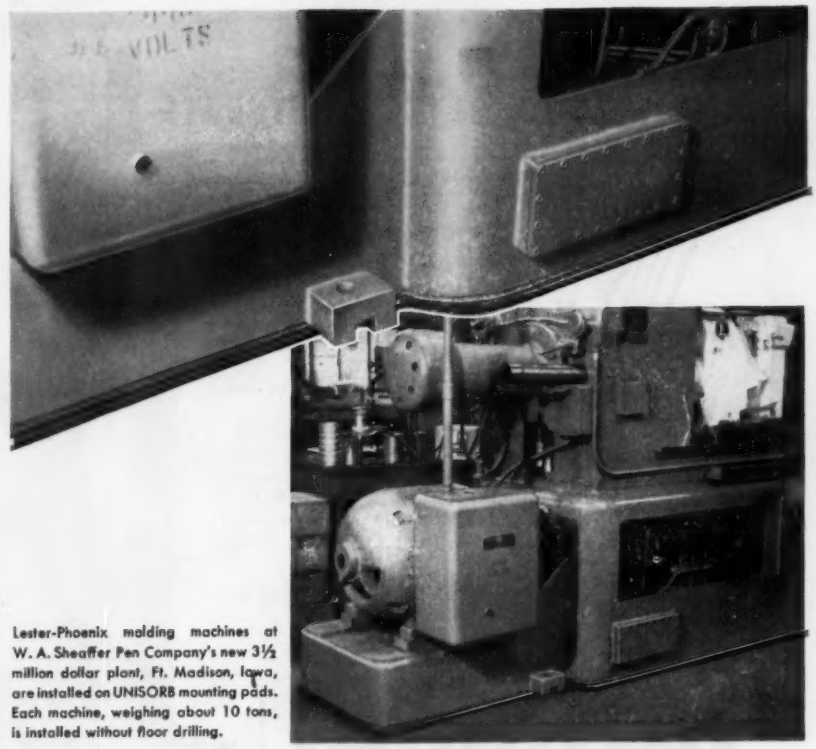
If the men in the shop would give the boys in the white shirts from the engineering department half a chance, they would soon find that they are made of the same stuff.

Frank J Zarnowski
Rutherford, NJ

THE FIGHTING Irish battled 779 years to regain their complete independence from Great Britain in 1948. If current events of the industrial revolution are any criterion, it will take just as much fight and just as much blarney to keep bad prints out of the shop.

Losses due to misleading blueprints are constantly cropping up in even the most efficiently organized enterprises. The blueprint says so much with so little. It is handled by many people, both carefully and carelessly. It presents a paradox in that there is room for error but no margin for it.

Experts solve the problem today only to have it come up a day, a week, or a month later. The clever efficiency expert says, "Stop the job when in doubt." The machine operator, blacksmith, or heat-treater says, "If I stop the job I go home for lack of work, and so do my buddies. If I



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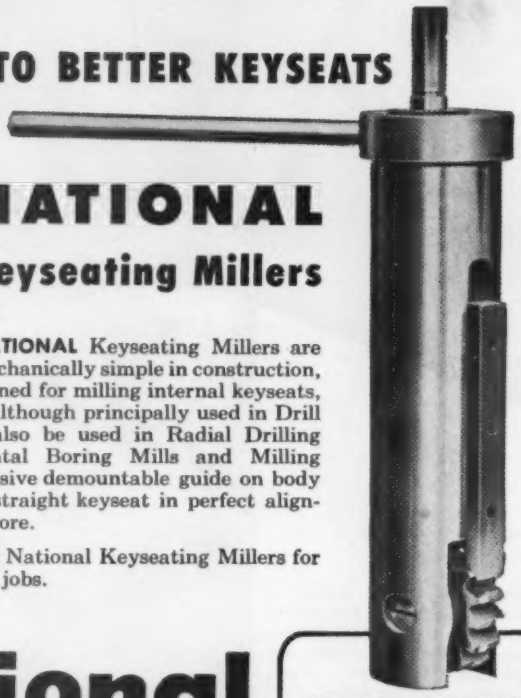

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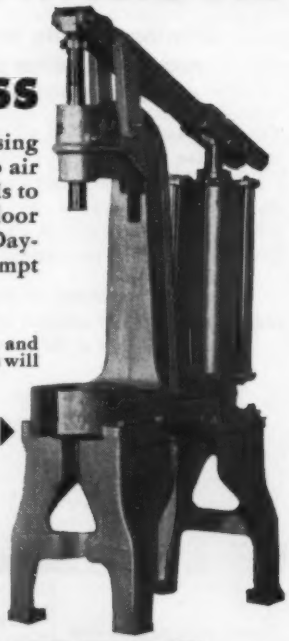

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guess wrong, the company pays, and they can afford it. They've got millions."

The labor leader would solve the problem with the guaranteed annual wage. There are those who think that is too strong a remedy for the disease.

In large manufacturing companies many experts must approve a print before it is made available to the shop. Each man personally signs or initials his OK. One draftsman makes the drawing, another checks it. An engineering draftsman approves the print.

A design engineer consults one or more of his associates and approves the print. A manufacturing engineer signs the print if his shop-planning and methods-planning men agree that it is OK. A materials engineer approves the print after consulting with a metallurgist. When the drawing has every required OK it is approved by a drafting supervisor.

In spite of all this care engineering errors do occur on drawings—not very often, but often enough to be a problem. If the drawing is small, or smudged, or carelessly handled, or contains confusing symbols, the margin of error, never allowed for in a blueprint, is increased.

A blueprint does more than merely indicate the mechanical dimensions to which a part is to be made. It indicates the material from which the part is to be made. It indicates the manner by which and the means through which the part is to be processed. The blueprint speaks for the design engineer. There is a tremendous amount of engineering know-how behind it.

Careless reading and careless handling of blueprints lead to costly errors. An experienced foreman is ever alert to prevent such waste and spoilage. He assures himself that all previous operations have been carried out before he proceeds with the processing of material.

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buyer purchased one hundred heavy forgings from a cheap source. The vendor rough-machined the forgings according to the blueprint. The print also called for a strain-anneal after rough-machining. The vendor either forgot to do this, or assumed that it was not a part of his contract. Annealing is a costly operation.

A foreman in the buyer's machine shop assumed that the forgings had been strain-relieved after rough-machining by the vendor. A previous vendor had always performed this operation quite faithfully. The forgings were promptly finish-machined without the stress-relief anneal called for by the design engineer.

The finish-machined forgings were inspected—and rejected. They had distorted after finish-machine. Salvage was now impossible. There is a lot more to blueprint reading than meets the eye.

Shortly after World War II a couple of ex-GI's purchased a few screw machines and went into business in Philadelphia. They had good connections. They received an order to machine several thousand pins about one inch round by six inches long.

They machined the pins according to instructions received over the telephone. The parts were sent out to be heat-treated. The first few hundred split wide open. The heat-treat metallurgist checked the pins. They had been made from seamy stock.

The ex-GIs were bankrupt. They cried on everyone's shoulder, but in vain. The heat-treater was not responsible because the material was defective, and no magnaflux test was specified before processing. The vendor of the steel refused a refund. The material purchased from him had been machined. Aircraft quality had not been specified.

The purchasing agent for the pins rubbed salt into the wound. "You should have asked for a blueprint," he said. "The blueprint specified aircraft quality material. It calls for a

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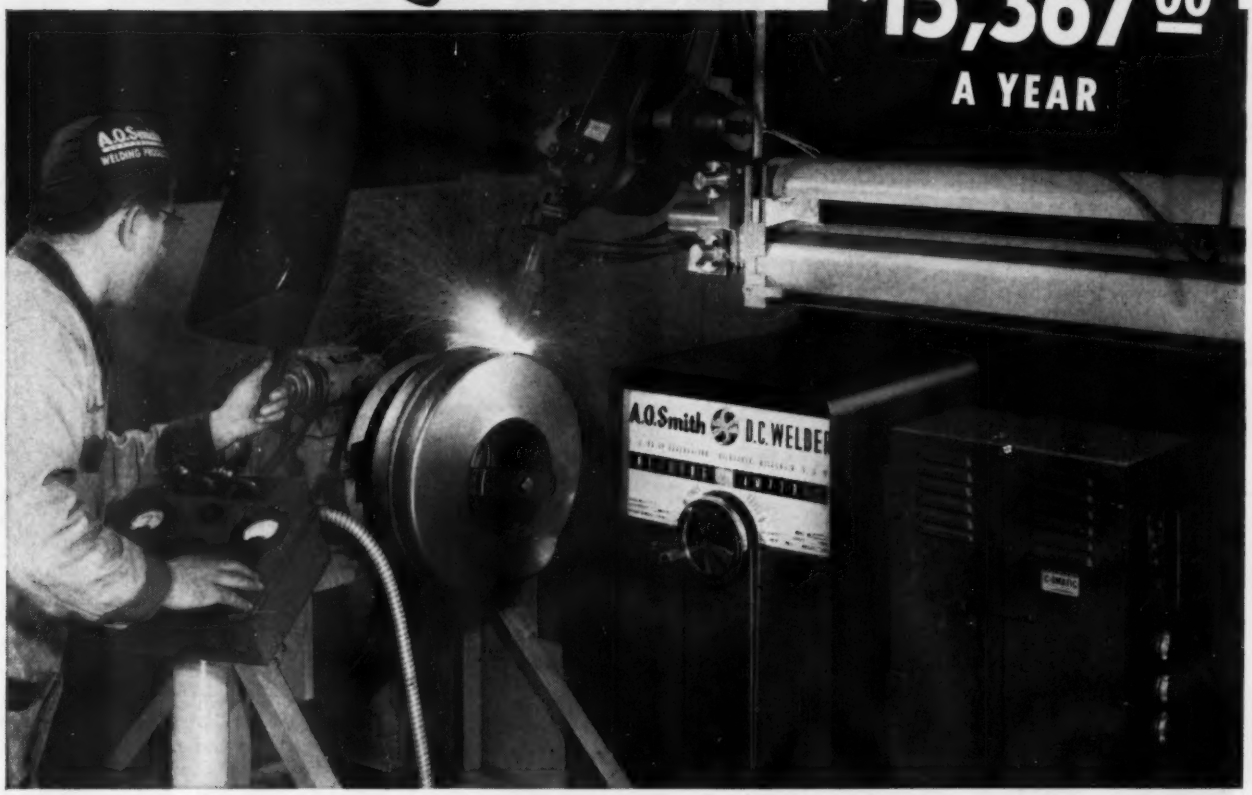

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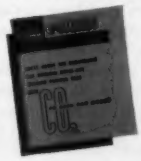

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magnaflux test and a heat-treat check before machining."

The shop foreman is responsible for the proper interpretation of blueprints. If there is anything wrong with a print, or if he suspects anything wrong, he should act promptly. Tell it to an engineer. Tell it to a waste and spoilage man. It's a feather in their cap to help the foreman maintain quality and reduce spoilage.

Most errors in blueprints are in the foreman's human nature. His best bet is to realize that other people are human too. Take nothing for granted. Stop, read, and reread. Think and think again. Keep the blues in the blueprint. And whatever you do keep it clean.

Peter A Seward
Swampscott, Mass

New Books . . .

HOW TO BUY CUSTOM MOLDED PLASTICS—*Published by the Society of the Plastics Industry, 67 W 44th St, New York 36, NY. 8 pages. Price $0.20 in quantities of under 100, minimum quantity 10 copies. Prices lower for larger orders.*

This little pamphlet gives detailed instructions on how to go about having a molded product made to your order. It lists information requirements of the molder, and tells how to pick a supplier; in fact, it gives enough data and tips that, if you were ordering a molded part for the first time, you should be able to do a good job of it.

•

ENGLISH-GERMAN TECHNICAL AND ENGINEERING DICTIONARY — *Louis DeVries, professor of modern languages, Iowa State College. Published by McGraw-Hill Book Co, 330 W 42nd St, New York 36, NY. 1014 pages 9x6. Price $20.*

The appearance of a new technical dictionary is not an event to make headlines, but by engineers, translators, and researchers this new book will be greeted with real enthusiasm. One of the major difficulties in translation is that so many dictionary makers are not thoroughly familiar with foreign engineering terms, for which literal translation is useless. In this volume, the technical terms are technically sound and rigidly accurate, and it contains over 130,000 terms used in all branches of engineering, technology, and industry. It goes, however, beyond the strictly

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Quenching from cyanide into Shell Voluta Oil 23 gives exceptionally clean part surfaces . . . often eliminates the need for after-quench cleaning.

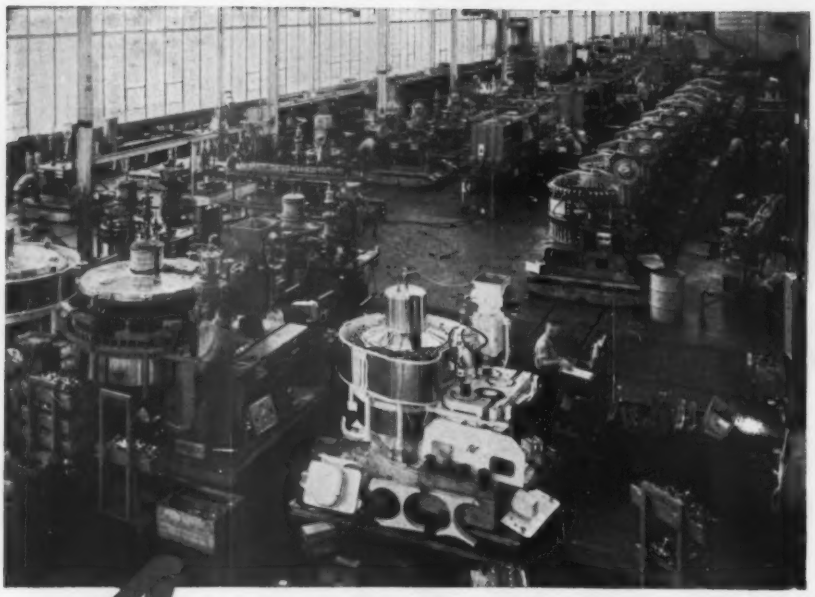
The cooling rate of Shell Voluta Oil 23 is high through the critical range, while its rate of cooling during martensitic transformation is essentially that of conventional oil. This combination is ideal for minimizing distortion tendencies.

3. **Stability in Service.** Extreme resistance to sludging and viscosity change has been achieved through the careful selection of well-refined base stocks and the use of special additives. Shell Voluta Oil 23 stays the same physically AND retains its high cooling rate. *Write for further details.*

SHELL OIL COMPANY

50 WEST 50TH STREET, NEW YORK 20, NEW YORK
100 BUSH STREET, SAN FRANCISCO 6, CALIFORNIA

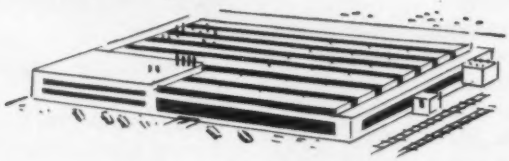
SHELL



At your service...

FOR THE PRODUCTION OF

complete machines, assemblies, sub-assemblies, machine parts



If you are faced with the problem of producing machines or parts for which your own equipment is not entirely adequate, you'll find Crown a reliable source for this kind of work. As one of the leading manufacturers of machinery for the soft drink, brewing and dairy industries, Crown has extensive machine shop facilities and a wealth of experience in producing precision parts and assemblies of the highest order. Let us show you how our plant and organization can serve you.

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technical and contains thousands of general words and terms which are necessary for clear, precise interpretations.

The peculiarities of the English language, in which a single word may have several different meanings, according to the particular industry which uses it, make translations extremely difficult. This new dictionary simplifies the job by the use of suitable phrases. For example, to mill metal is fräsen, to mill soap is pilieren, to mill a coin is kraüseln

Terms in current use in the fields of radar, television, electronics, rocket and jet propulsion, and nuclear engineering are included, as well as translations of standard abbreviations.

•

BLUE BOOK—*Edited by Dr Victor G Mooradian, chief engineer, H A Wilson Co. Published by H A Wilson Co, 2655 US Route 22,, Union, NJ. 192 pages. Price $3.00 (Free to customers and prospective users requesting it on company letterheads.)*

Designed as a complete reference book on Thermometals (thermostatic bimetals, sintered metals, electrical contact materials, composite and laminated metals, and special alloys), this new work lists hundreds of materials, their properties and applications. It provides charts, formulas, and diagrams basic to research and design work. There are 100 charts to help the engineer determine rapidly the general type, size, shape, and fabrication of Thermometal suitable for a particular job.

The section on contact materials outlines composition-choice factors, classifies the materials, and describes the properties and applications of each. Methods of contact assembly are discussed.

A complete description of the new nickel-chromium-iron-titanium alloy, called Ni-Span C, is given.

New Films . . .

IN THE CHIPS. *Produced by Chase Brass & Copper Co, Waterbury 20, Conn. 16 mm, sound, color. Running time 24 min. Also available from Chase sales offices in various cities. No charge.*

By means of graphic close-ups and animation, this latest in the Chase series of motion pictures gives a

DISSTON

HAS THE EDGE®

Ask for Disston Super-Safe Hack Saw Blades

and blades that hold it!

to give you faster, straighter power hack sawing

Here's the sharpest, cleanest cutting machine hack saw blade the industry has ever seen. These blades set a new standard of quality and safety. They are completely new—made by new methods, with the latest equipment. No wonder they easily meet the toughest production requirements.

Let us show you how much you will benefit. Call your Disston Distributor today. He'll put on a practical demonstration *right in your shop*. He'll let you make your own side by side comparison tests on your own machines. Also ask him about Disston's complete line of *Hand* Hack Saw Blades and Frames—for the same economies and results.

For prompt service, expert advice, reliability, many economies, on these and other Disston metal cutting products—Files, Band Saws or Solid and Inserted Tooth Metal Circular Saws, rely on your Disston Distributor. You'll get far more for your tool dollar.

send for this FREE production help!

Write for handy folder on Disston hack saw blades. It includes helpful hints to your shop men on the right number of teeth, feed and stroke—for various metals. It can save hours of production time.

Name_____ Title_____

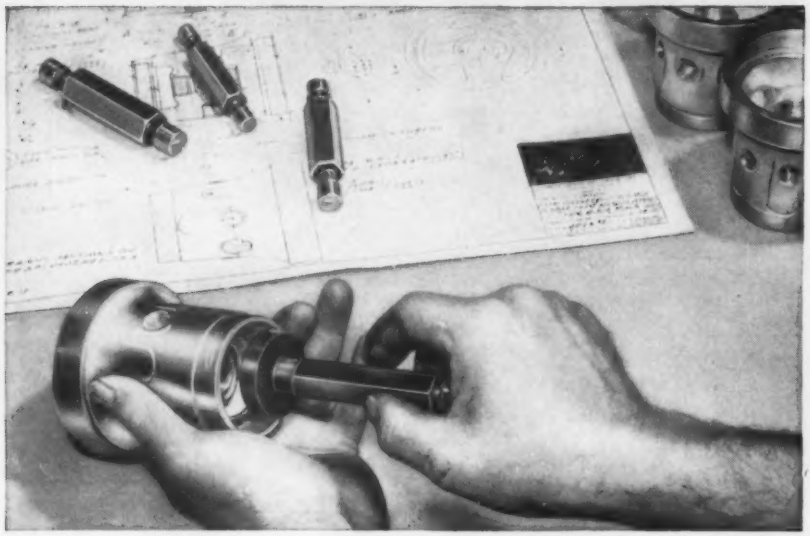
Company_____

Address_____

Mail to Henry Disston & Sons, Inc., 620 Tacony, Philadelphia 35, Pa., U.S.A. In Canada, 2-20 Fraser Ave., Toronto 3, Ont.

Linde FLAME-PLATING NEWS

News of another successful use of LINDE'S process for applying a tungsten carbide coating to metal parts.



Flame-Plated plug, ring, and air gages have extra-high wear resistance for long-lasting accuracy.

Flame-Plated Plug Gages Outwear Carbide Gages 3-1... Hard Chrome Plated Gages 20-1!

Flame-Plating, a LINDE Service for depositing a thin coating of hard, wear-resistant tungsten carbide on metal parts and many tools, continues to be used with highly successful results on plug, ring, and air gages. The wear-resistant tungsten carbide coating, applied in LINDE'S Flame-Plating plant, gives gages lasting accuracy through a longer wear life. Flame-Plated plug gages, for example, have actually outworn solid sintered tungsten carbide gages 3 to 1...hard chrome plated gages 20 to 1.

TEMPERATURE COMPENSATION PROBLEMS REDUCED

Flame-Plated gages have the same coefficient of thermal expansion as the gage base metal. When the gage base metal is similar or identical to the part being gaged, temperature compensation problems are either greatly reduced or eliminated entirely.

CHIPPING AND BREAKAGE PRACTICALLY ELIMINATED

Flame-Plating a gage with tungsten carbide produces a hard, wear-resistant surface while retaining the toughness of the base metal. Thus, the problem of breakage is greatly minimized especially on small diameter gages. The tungsten carbide coating is also highly resistant to chipping. These factors are important advantages over solid sintered carbide gages.

AVAILABLE NOW AT LEADING GAGE SUPPLIERS

Flame-Plated plug, ring, and air gages are now available in standard AGD sizes. Plug gages from .059-in. up. Ring gages from .375-in. up. Ask your gage supplier how you can cut inspection costs with Flame-Plated gages or call the LINDE office nearest you. Send for your free copy of the Flame-Plating booklet today.

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A Division of Union Carbide and Carbon Corporation
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Offices in Principal Cities
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Division of Union Carbide Canada Limited, Toronto

Linde Trade-Mark

The term "Linde" is a registered trade-mark of Union Carbide and Carbon Corporation.

clear insight into what happens when a tool bites into free-cutting brass rod, why short chips mean easier machining and smoother and cleaner finishes, and how proper alloying of the rod can increase tool life. It will be particularly interesting to those who work with brass rod and wire, or who use nonferrous forgings.

•

PULLMAX AT WORK. *Produced by American Pullmax Co, Inc, 2455 North Sheffield Ave, Chicago 14, Ill. 16 mm, sound, black & white.*

Just released, this new film gives a complete description of the company's line of sheet and plate working machines. It describes the construction and gives detailed demonstrations of straight cutting, beading, folding, joggling, dishing, slot cutting, and louver cutting.

•

ONE TO A CUSTOMER—*Produced by Aetna Casualty & Surety Co, Hartford, Conn. Running time 11 min. No charge.*

Safety movie demonstrates advantages of personal protective equipment, such as goggles. It shows the specific hazards which many kinds of devices were designed to combat.

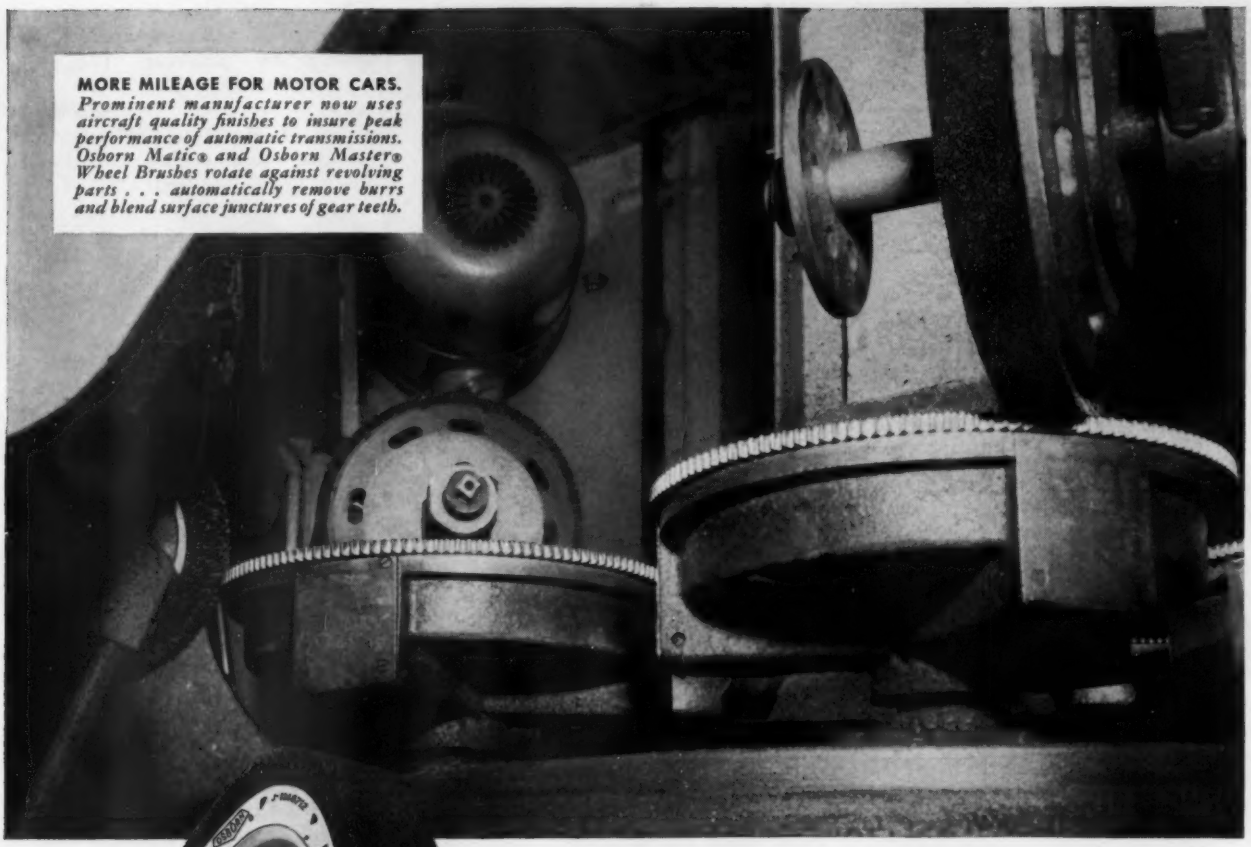
Names in the News . . .

Donald E Wingate, formerly with Surface Combustion Corp, has been appointed chief engineer of Ipson Industries, Inc, Rockford, Ill, manufacturer of production heat treating furnaces and equipment.

Emmett Geibel has been named chief engineer of the Effingham, Ill, plant of Borg-Warner Corp's Norge Division.

T C Carlsen, head of metal parts manufacturing at Bell & Howell Co, Chicago photographic equipment manufacturer, has been appointed general superintendent of metal parts manufacturing and assembly. **Oscar Riese,** foreman of castings, succeeds Mr. Carlsen.

Elmer Syrene, formerly general manager of the E Westberg Corp, East Syracuse, NY, has been appointed special projects engineer for the Westberg Colletmandrel line,



MORE MILEAGE FOR MOTOR CARS. *Prominent manufacturer now uses aircraft quality finishes to insure peak performance of automatic transmissions. Osborn Matic® and Osborn Master® Wheel Brushes rotate against revolving parts . . . automatically remove burrs and blend surface junctures of gear teeth.*

Osborn Matic®... *Industry's Most Efficient Brushing Tool*

FINISHING TOUCH...automatically adds aircraft quality to production

Important benefits an OBA could add to your products

Doubles endurance limits. Records show that sharp corners, tool and grinding marks can reduce endurance limits of machine parts as much as 60%. Many manufacturers of other products now require aircraft quality finishes in the range of 4 to 7 microinches to insure peak endurance on highly stressed parts at maximum economy in production.

Parts are now simply rotated against revolving Osborn Power Brushes on preset time cycles. Sharp edges or surface junctures are uniformly blended, eliminating causes of stress concentrations and possible failure. Small metal particles are removed, avoiding subsequent fouling of hydraulic and lubricating systems.

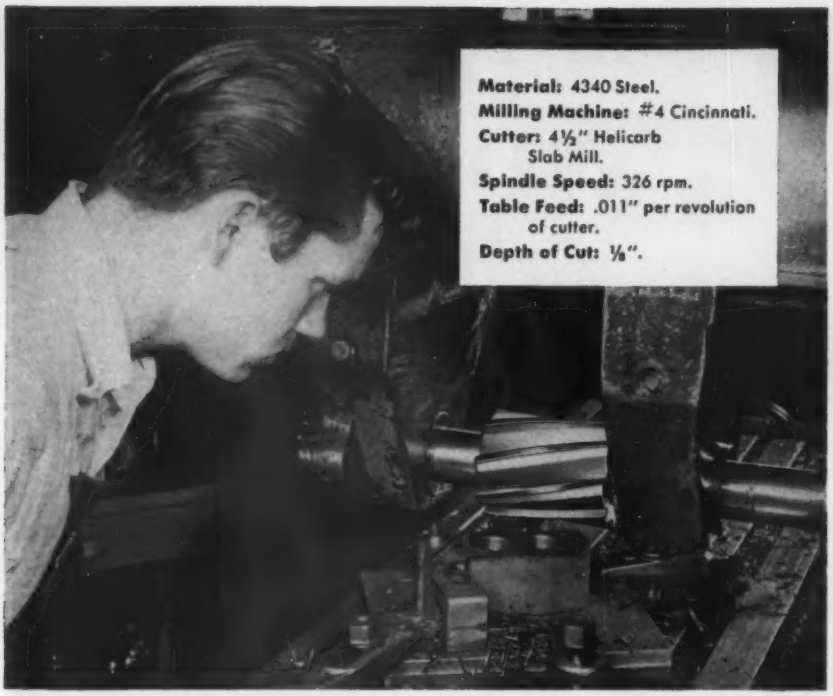
The power brushing operation is simple . . . requires only loading and removing the part.

Whatever the type of product you build, Osborn Power Brushing can improve quality and cut cost of manufacture. An **OBA**, **O**sborn **B**rushing **A**nalysis, of your job will show you how. Write *The Osborn Manufacturing Company, Dept. C-34, 5401 Hamilton Avenue, Cleveland 14, Ohio.*

Osborn Brushes

OSBORN

BRUSHING METHODS • POWER, PAINT AND MAINTENANCE BRUSHES
BRUSHING MACHINES • FOUNDRY MOLDING MACHINES


Material: 4340 Steel.
Milling Machine: #4 Cincinnati.
Cutter: 4½" Helicarb Slab Mill.
Spindle Speed: 326 rpm.
Table Feed: .011" per revolution of cutter.
Depth of Cut: ⅛".

On this 4340 ***STEEL*** *application*

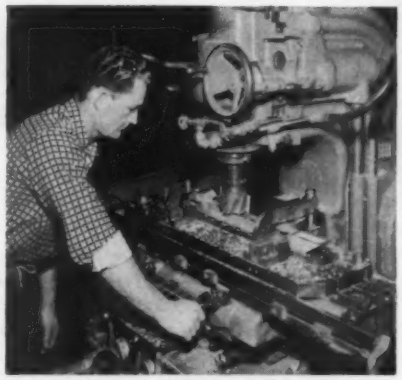
Sonnet Helicarb Helical Carbide Slab Mills cut floor-to-floor time 57%

The Talley Machine & Manufacturing Corporation, Los Angeles, uses a 5" "Helicarb" Slab Mill on a ⅛"-deep slab cut. Formerly high speed steel cutters were used for the same operation, completing the cut in 3½ minutes. The change to "Helicarb" Cutters cut floor-to-floor time to 1½ minutes, *enabling two parts to be produced in less time than formerly required to produce one.*

The operator also reported that after 100 parts, "the Helicarb cutter was still sharp; many more cuts could be made before resharpening."

No secret to the amazing efficiency of "Helicarb" cutters. Since the included cutting angle is uniform over the full length of the flute, the cutter cuts with a shearing action as contrasted with the impact of a straight-tooth carbide cutter. Finishes, too, are improved, with 20 r.m.s. and better not unusual.

Right now hundreds of shops are enjoying the competitive advantage these new cutters give them. Why not you? A "Helicarb" Catalog can be had for the asking by writing Sonnet Tool & Mfg. Co., 574 No. Prairie Avenue, Hawthorne, California.



ALUMINUM **applications show even better results.** Airframe manufacturers and sub-contractors are now using "Helicarb" cutters widely. Above, a standard 4" "Helicarb" Shell Mill, ground with a radius, is used for a simultaneous facing and side milling operation on an aluminum casting at Chrysler Corporation's Los Angeles plant. The 2-inch-long helical flute, possible with "Helicarb" design, enables the cut to be made in one pass, eliminating multiple cuts which might create stress points.

recently acquired and now manufactured by Erickson Tool Co, Cleveland, Ohio.

Herbert J Knudten, president of Universal Engineering Co, Cedar Rapids, Iowa, has been elected vice president of the firm's parent company, Pettibone Mulliken Corp, Chicago. He will continue to head the subsidiary.

Mathias Klein, formerly chief production engineer of Curtiss-Wright's Propeller Division, has been named chief manufacturing engineer of Marquardt Aircraft Co, Van Nuys, Calif.

James K Sutherland, formerly general manager of steel operations for Ford Motor Co, has joined Sun Steel Co of Chicago as executive vice president.

John A Simkus, a general foreman at Stewart-Warner Corp, Chicago, has been named to the newly created post of production engineer.

Minnesota Mining & Manufacturing Co names: **Clarence B Sampair,** vice president, production, to head, in addition, the tape and ribbon products group; **Joseph C Duke,** vice president and general manager of the coated abrasives and related products division, to also assume responsibility for the adhesives and coatings division; and **Hubert J Tierney,** vice president in charge of tape manufacturing and research, to additionally head a newly formed plastic division.

R B Fulton, representative in the Cincinnati district of Allis-Chalmers general machinery division, has been appointed district manager. He succeeds **W F Daly,** who is retiring June 30.

James W Allen, sales engineer for Pacific Electric Motor Co, Oakland, Calif, has been appointed manager of fabrication and repairs, a newly created post.

Norman K Pettigrew, formerly sales manager of C I Hayes, Providence, RI, has joined the executive staff of Sargeant & Wilbur, Inc, Pawtucket, RI, manufacturer of industrial furnaces and equipment.

George E O'Brien, factory manager at Rockwell Mfg Co's new water meter plant at Uniontown, Pa, has been transferred to the company's Brooklyn, NY, plant as foundry manager.

Steel-Weld FABRICATION

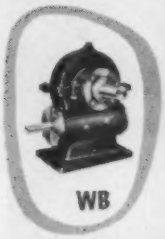
Use WELDED STEEL for Greater Strength with Less Weight!

Parts, assemblies and products, such as those illustrated at left, and the steam condenser unit being fabricated in the illustration above, are typical of thousands of Steel-Weld Fabricated units produced and machined by Mahon for hundreds of manufacturers of processing machinery, machine tools, and other types of heavy mechanical equipment. Mahon's service to buyers of welded structural or heavy plate fabrications is complete—including magnetic and radiographic inspection, machining, and assembling if desired. If you are a buyer of weldments, or welded steel in any form, you, too, will find in the Mahon organization a unique source . . . a source where design skill and advanced fabricating techniques are supplemented by craftsmanship which assures a smoother, finer appearing job embodying every advantage of Steel-Weld Fabrication. See Sweet's Product Design File for information, or write for Booklet showing Mahon facilities and capabilities in this field.

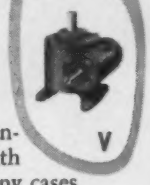
THE R. C. MAHON COMPANY
DETROIT 34, MICHIGAN

Engineers and Fabricators of Steel in Any Form for Any Purpose

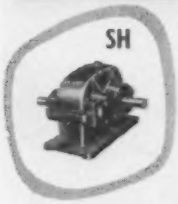
MAHON



Grant Speed Reducers

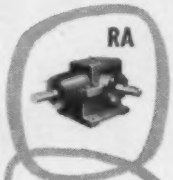


YOUR ASSURANCE OF BETTER PERFORMANCE



The *real* criterion for reduction units is unfailing performance over the years, with minimum maintenance. Our files show many cases where Grant Reducers are still providing every-day service, after two decades, without a breakdown.

What's back of such performance? Extra-quality features built into each Reducer, by gear experts . . . totally enclosed cast iron housings, radial thrust ball bearings, precision high-test bronze gears and worms of chrome vanadium steel. These features mean money in your pocket through trouble-free operation.



Grant manufactures a complete range of types and sizes — worm, double worm, compound worm and spur, helical and mitre gear — with reductions up to 3660-1 — most available from stock. Write for the latest catalog, describing each type in detail.

AGMA

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SPEED REDUCERS

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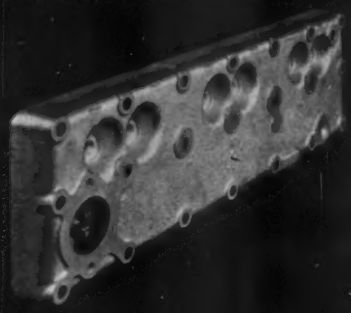
BORES MOTOR BLOCKS 22% FASTER— AND WITH 28% LESS TOOL WEAR



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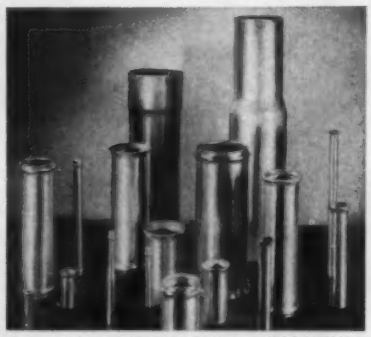
Users everywhere report similar experiences. In fact, on 67 machining tests in 11 large machine shops, castings of gray iron treated with FERROCARBO averaged 89.5% greater machinability per tool than untreated castings. These premium castings are finer-grained, denser, stronger, yet they COST YOU NO MORE . . . because your foundryman, using FERROCARBO, makes worthwhile savings in raw material costs.

FOR FREE BOOKLET on FERROCARBO, citing actual case histories of faster machining, with longer tool life, write The Carborundum Company, Dept. 14, Niagara Falls, N.Y. 64-54

CARBORUNDUM®



Typical tube-end forming handled on Vaill Machines

You name the application Vaill will furnish the

TUBE-END FORMING EQUIPMENT

Many manufacturers are improving their products by designing for the application of end-formed tubing—and using Vaill TUBE-END FORMING MACHINES for such operations as: Beading . . . Flaring . . . Expanding . . . Reducing . . . Sinking . . . Swaging . . . Grooving . . . Double Lap Flaring and Flanging . . . or combinations.

Vaill TUBE-END FORMING MACHINES . . . for air, hydraulic, or mechanical-operation are available to meet YOUR needs, easily, quickly and economically. Full details on request.

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BUZZER Equipment, a buy-word since 1911, provides the hottest and quickest heating . . . without blower or power. Wide range of turn down and heat control. You can depend on a BUZZER.

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Oven Furnaces

Mfrs. since 1911

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BURNERS - FURNACES (Heat Treating, Melting, Soldering)

at the machine tool show

AT SPACE 310

the world's best investment . . .

in lathes

It's the brawny, extra rigid Boye & Emmes Engine Lathe.
The lathe *you would have designed for your own use.*
See it! Compare it with the finest. You will gain
a new notion of modern engine lathe design.

Longitudinal power traverse through fingertip electrical controls.
Automatic, electric longitudinal and cross stops *operate in either direction of travel.*
Hardened and ground lead screw.
Electrically operated brake.
Direct reading longitudinal and crossfeed dials.
Built-in ball bearing tailstock.

Promise yourself the pleasure
. . . at space **310**

BOYÉ & EMMES
MACHINE TOOL COMPANY
127 CALDWELL DRIVE
CINCINNATI 16, OHIO

Horizontal Swivel Type
MULTI-PURPOSE
WONDER GRIP VISES
4 STEPPED JAWS PERMIT CLAMPING of rough castings, irregularly shaped, round, and tapered pieces accurately and quickly, eliminating need for special jigs or fixtures. Narrow stepped jaws allow free access to and measuring of work pieces and provide clearance for cutting tools. Small work pieces machined on three sides without reclamping. Easy and quick to mount and align on any machine. Holds rigid in any position without vibration. Various capacities and extra soft jaws available.
Horizontal & Vertical Swivel Type
TAPPING
ATTACHMENTS
Reversible safety tapping attachments with adjustable graduated friction drive, hardened, ground and lapped, complete with torque bar and handles. Precision made throughout by long established reputable West German factory.
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Also United States Distributors of European Machine Tools
Tested for Performance to High Amer. Standards
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MADE IN GERMANY
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From the *American Machinist* Library of *Tips for Top Shop Men*

THE really competent man multiplies his effectiveness by every man he influences. One man, no matter how able, is still one man, but one man believed in by enough others is unbeatable.

HERE'S YOUR CONSTANT INDEX TO MORE PROFITABLE PRODUCTION

This is just a reminder there's an easy way in which to get information in a hurry for solving those knotty production problems you're faced with daily.

Listed below is a general subject index to the answers you need, as you'll find them in your 1955 PRODUCTION PLANBOOK issue of *American Machinist*.

- **A** Management, Personnel
- **B** Machining
- **C** Tooling
- **D** Pressworking, Molding, Casting
- **E** Inspection, Testing, Quality Control
- **F** Assembly, Welding, Portable Tools
- **G** Heat-Treat, Cleaning, Finishing
- **H** Materials, Components
- **I** Materials Handling, Services
- **J** Prize Ideas, Rebuilt Equipment

And that's not all. An integral part of these ten sections are hundreds of informative advertisements . . . a list of manufacturers offering free product literature . . . and an alphabetic listing of products and services advertised in the PLANBOOK.

Information like this can help you find sure roads to faster, lower-cost production.

American Machinist
McGraw-Hill Building
New York 36, N. Y.

Tool Steel Topics

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

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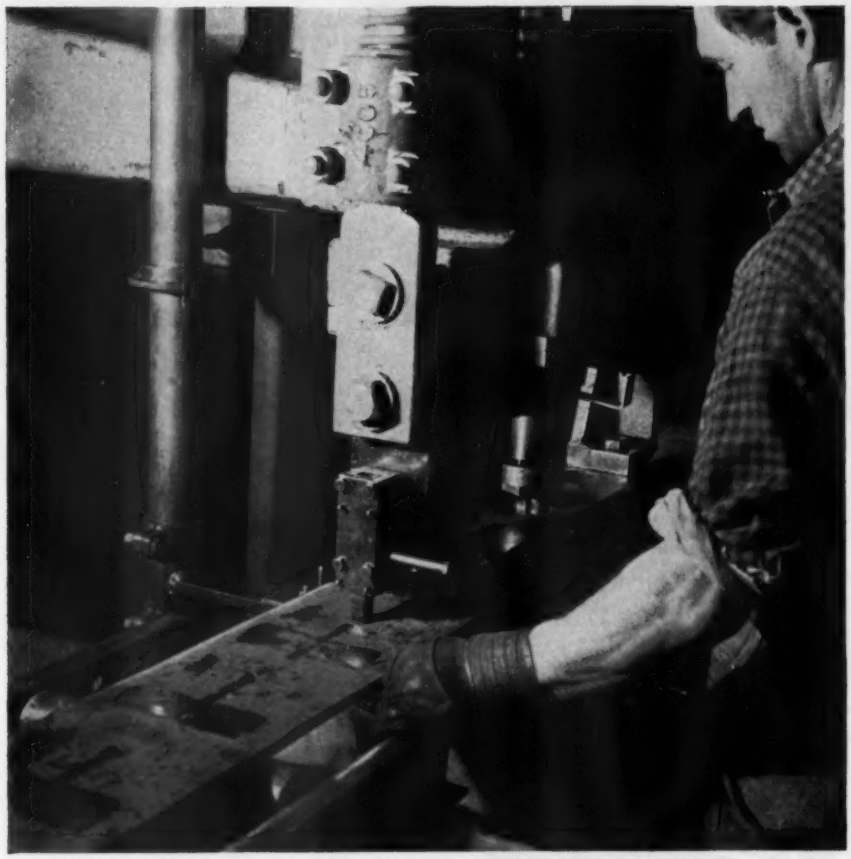


This Bearcat punch (shown above man's wrist) punches 15 square holes in each ½-in. steel plate, used as cutting edge of snow plows. Average life of punch is 5500 holes, with only three light redressings.

See What They Gained by Switching to Bearcat!

One of the operations performed in the shops of Frink Sno-Plows, Inc., Clayton, N. Y., is punching 15 holes, 11/16 in. square, in a carbon-steel plate. The plate, ½-in. thick, is used as the cutting edge of highway snow plows. With grades of steel previously used in this punching operation, the service life of each punch varied considerably—anywhere from 300 to 1500 holes.

We felt confident that Bearcat tool steel could do better, and they agreed to give it a trial.

So Bearcat was put to work, with the punch hardened to Rockwell C56-57. Production went up immediately. Now the life of each punch is approximately 5500 holes, with only light redressing of the corners required every 1500 holes or so.

Bearcat is a tough, general-purpose air-hardening tool steel. When used in punches, its chief advantages are exceptional resistance to shock, and superior resistance to wear. Besides, Bearcat's air-hardening characteristic minimizes quenching hazards, and provides good resistance to distortion in heat-treatment.

In addition to punches, there are many other applications where Bearcat can be used to advantage: rivet sets, for example, and chisels, gripper dies, hot headers, master hobs and die-casting die inserts, to name only a few.

Why not learn for yourself how good a tool steel Bearcat really is! You can order it right now through your Bethlehem tool steel distributor. It can also be obtained from our well-stocked mill depot.

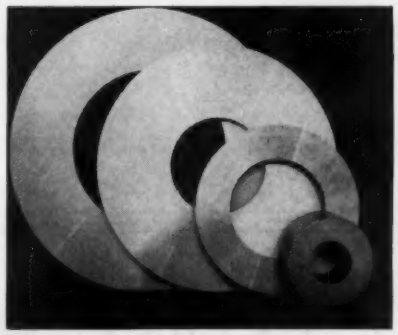
BETHLEHEM TOOL STEEL ENGINEER SAYS:

Switching Grades Won't Cure Tool Troubles

Granted that quality is of primary importance in tool steel. But there are four other factors which are also essential to the satisfactory performance of tools: (1) good design, (2) correct heat-treatment, (3) proper grinding, and (4) proper application and mechanical use of the tool.

Ordinarily a manufacturer's responsibility lies only in quality. Yet if results are unsatisfactory the user often concludes that "the steel is no good," whereas any of the other factors mentioned may be the real culprit. That is why it is so important to investigate all five of these factors. For they are like links in a chain: unless they are in reasonably good balance, trouble can be expected. When this happens, the tool and its work must be investigated thoroughly before a remedy can be suggested.

In the majority of cases, switching grades is not the answer in attempts to cure trouble with tools, for the difficulty usually lies elsewhere. Before switching grades, the user should first have a clear-cut reason for doing so, and definite objective. Otherwise, the original trouble may be intensified, rather than removed.



BETHLEHEM HOLLOW-BAR SAVES TIME IN RING-TYPE APPLICATIONS

If you work with ring dies, draw rings, or hardened bushings, you can save time by using Bethlehem Hollow-Bar Tool Steel, either in BTR (oil-hardening) or Lehigh H (high-carbon, high-chrome). Hollow-Bar is made by high-speed trepanning. By this process, hammer-forged or hot-rolled bars are cored out, and are then rough-turned on the outside. With Hollow-Bar, there's no need to wait for forged rings or discs.

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Inside diameters are the hole difference between Lamina Bronze Plated guide pin bushings and ordinary guide pin bushings . . . the difference between costly downtime and continuous, trouble-free press operation.

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If you have dies in your plant equipped with ordinary bushings, you know the headaches that occur. Now, you can do away with press downtime due to bushing failures. You can reduce part rejects and maintenance costs, increase die life by installing Lamina Bronze Plated guide pin bushings. For the whole story, contact your local die set manufacturer or write to us for your free copy of our new Guide Pins and Bushings catalog.

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WRITE FOR BULLETIN 39-A-10

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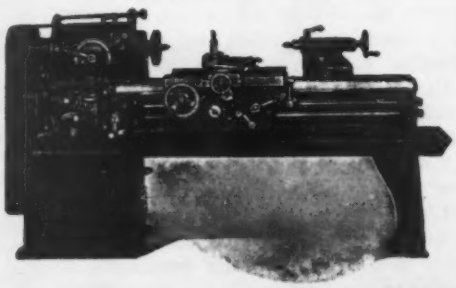

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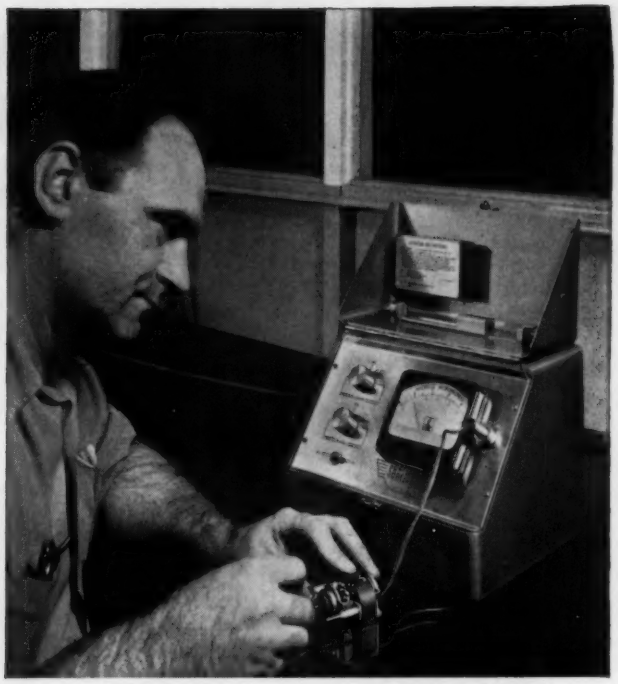
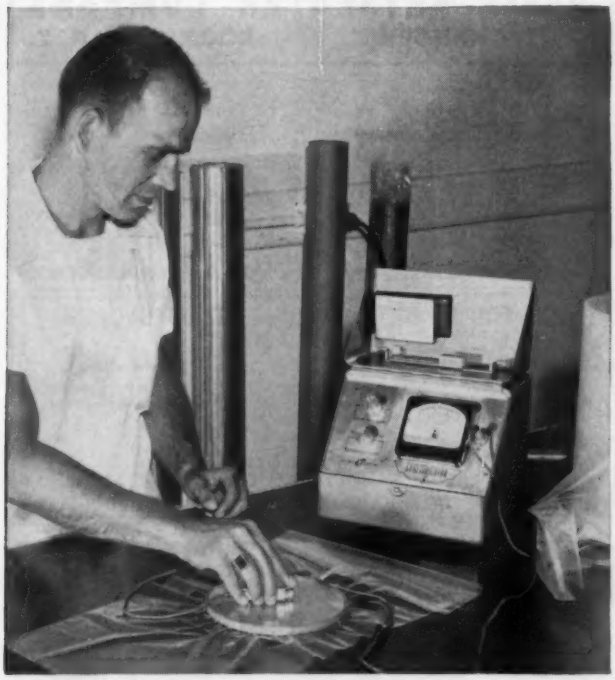
"Saves inspection time" reports Rockford Acromatic Products Company. SURFINDICATOR is used to check finish of automotive, farm implement and appliance screw machine parts.



"Eliminates arbitrary decisions" reports Zenith Radio Corporation, producer of many ordnance parts with specified microfinish. Positive checks of surface finish cut production costs.



SURFINDICATOR is not restricted to metal surfaces. Here instrument is used by Celanese Corporation of America, 24 hours a day, in regular quality control checks of plastic film.

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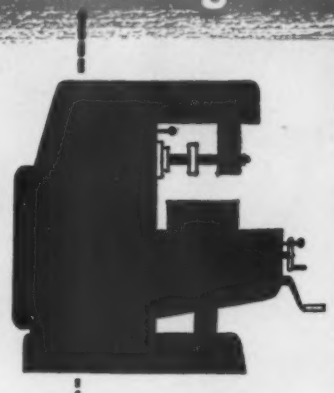

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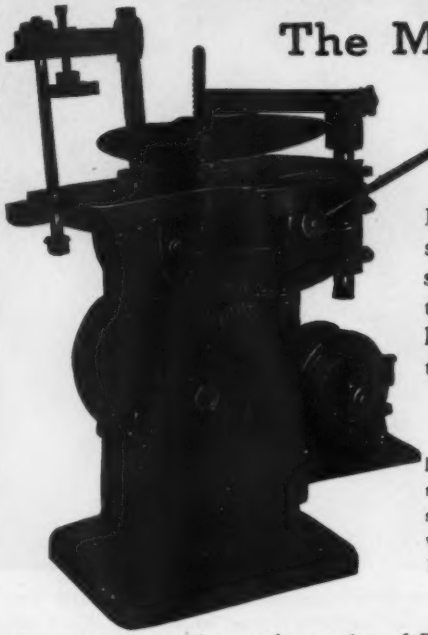

Illustration shows typical set-up for cutting taper keyways with table tilted.

Machines are made in three sizes for keyways 1/16" to 1" in width.

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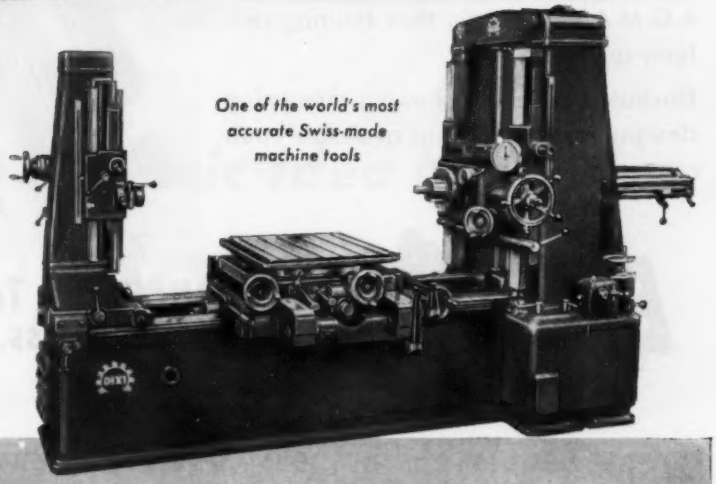

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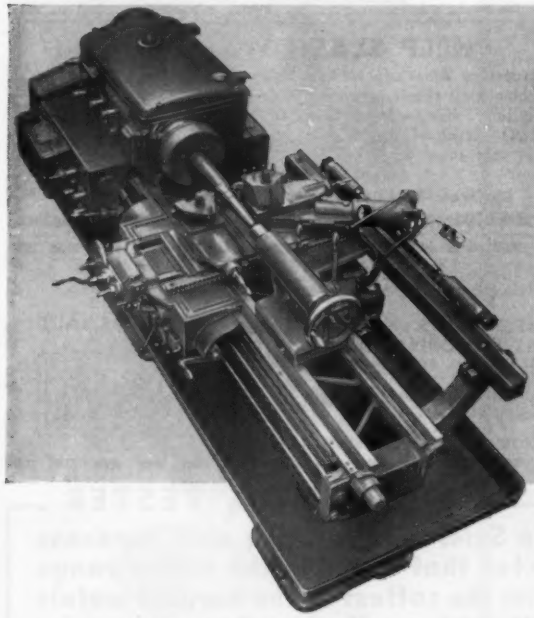

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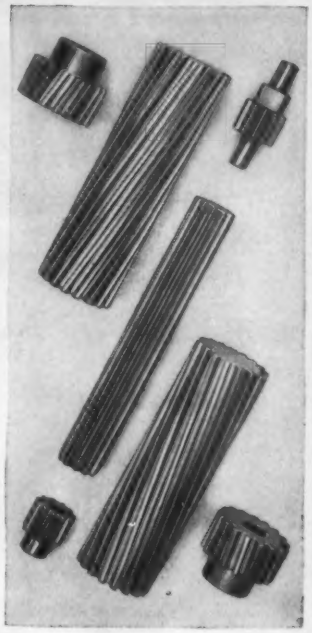

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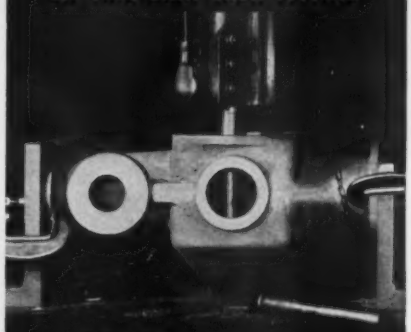

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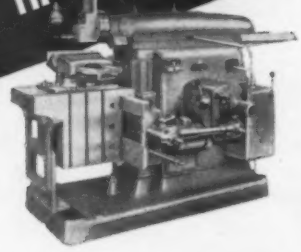

18", 22", 26"
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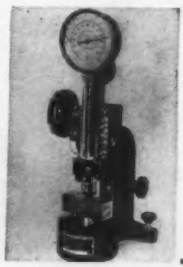

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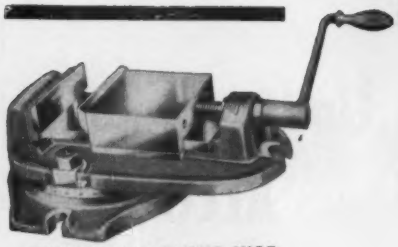

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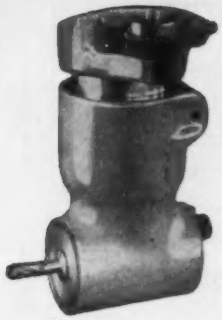
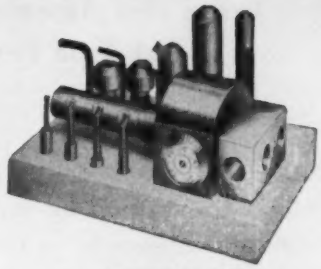


(Above) Heavy Duty . . . for milling and drilling at right angles; fits both Master and 1 HP Bridgeport Heads.

(Below) Light Duty . . . for right angle milling and drilling narrow, deep molds and cavities.

RIGHT ANGLE ATTACHMENTS



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Boring Tools and Holder provide means for boring holes up to 6" diameter; available for use on Bridgeport 1 HP Milling, Drilling and Boring Attachment.

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Makes possible production of convex and concave shapes. Ideal for producing drop forge dies, molds, cavities.

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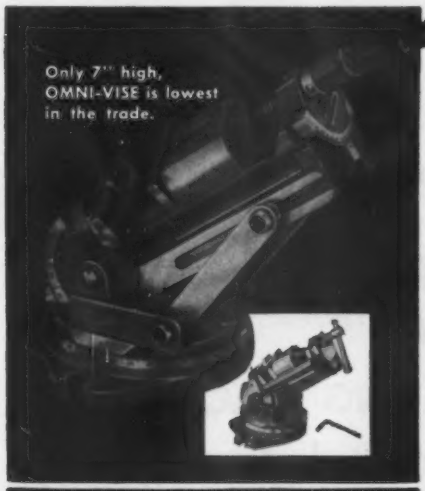
SOME wag said long ago that it isn't smart to step on other men's hands as you go up the ladder—you may need their help coming down. It's just as true that the man who makes his way up by slipping a knife in the back of the man above, spends his time up there ineffectually because he's always got one eye cocked over his shoulder, watching for the knife.



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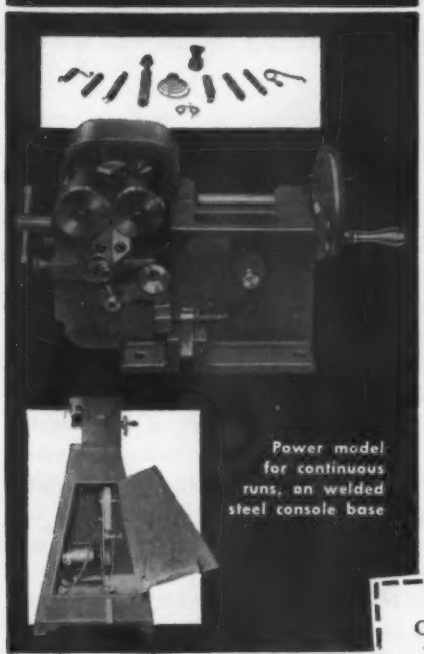

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Understanding ALLOY STEELS

By removing the cloak of mysterious, highly technical terminology, this *American Machinist* Special Report clarifies the differences in commonly used alloy steels.

Alloy steel is just plain carbon steel to which one or more other elements are added to change some property or properties of the base material. These elements may affect the mechanical, magnetic, or chemical properties of the steel. This report discusses the relationship of alloy steel to plain carbon steel, and describes the alloy properties in terms of the standard classification.

This is one of a new series of *American Machinist* reports written to simplify metallurgy for the non-metallurgist. Earlier reports in the series discussed brass, and plain carbon steel.

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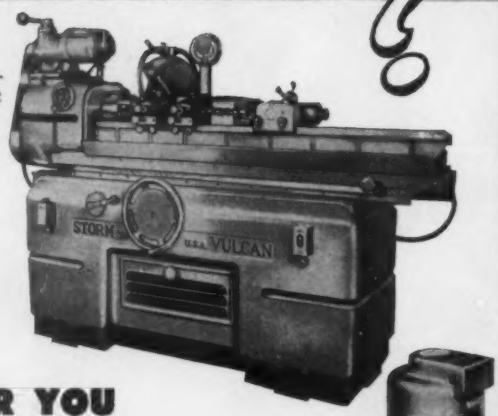

Illustrated is a Storm-Vulcan 375 Camshaft Grinder on which Ruthman Gusher Coolant Pump is standard equipment.

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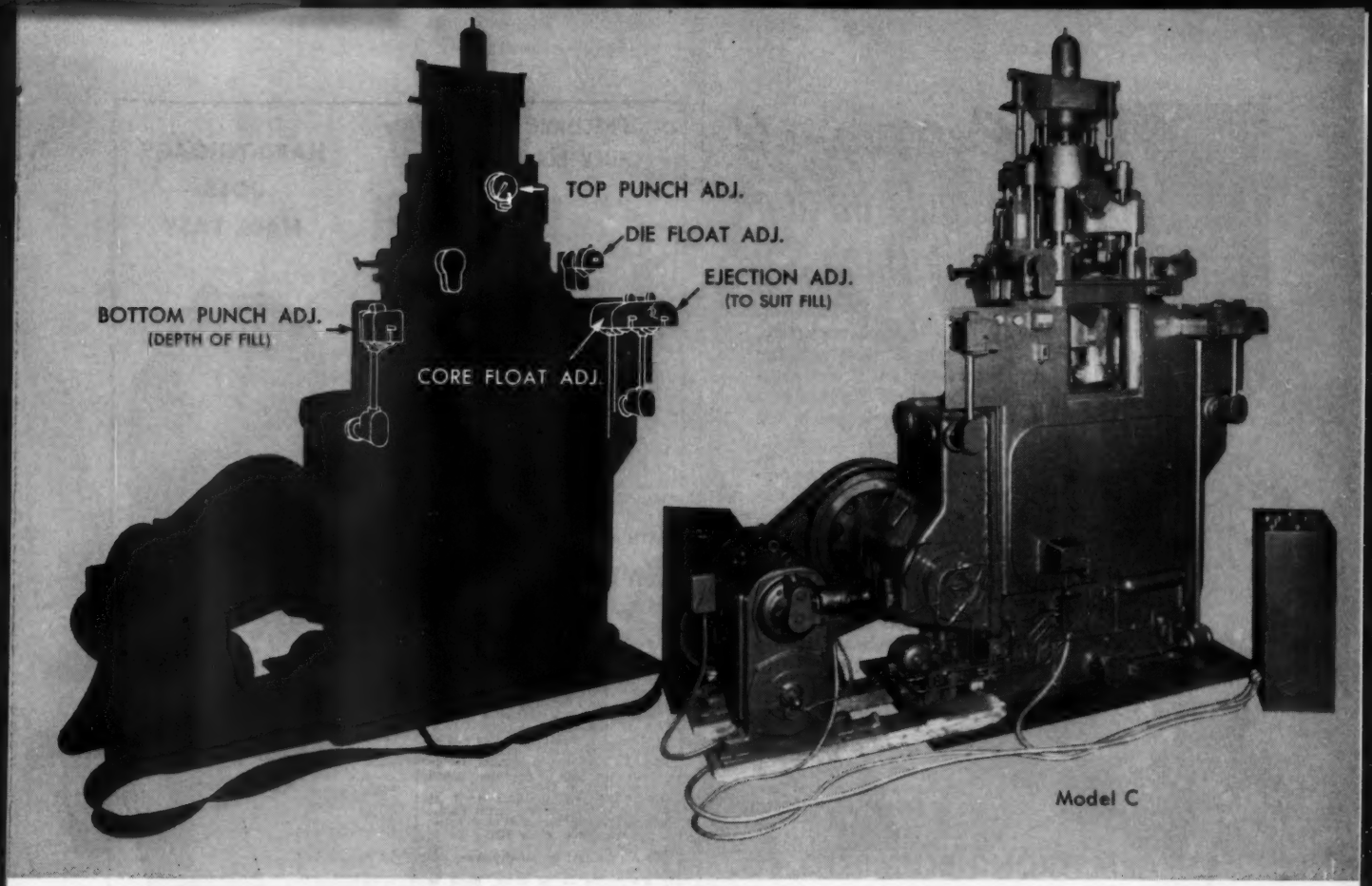

INDIVIDUALIZED COMPONENTS of new Baldwin powdered metal presses make adjustments easy

It's mighty easy to make adjustments in density or weight in Baldwin's new Model "L" and "C" presses. That's just one of the results of a new concept of compacting powdered metals.

These revolutionary new Baldwin presses are not just remodeled heavy-duty pill presses. They have been designed expressly to meet your end product's needs. For example, instead of having combinations of actions, press components have been individualized. That enables you to make adjustments easily to fit any job.

Since there are no cams to change, many of the adjustments can be made while the presses are in operation. Also all controls are concentrated on one panel for easy supervision and adjustment. Two separate controls adjust the depth of fill and the stroke of the bottom punch. The relative position of the core rod to the die is also adjustable to aid in controlling the fill when making counterbored parts.

Further evidence of Baldwin's new concept includes such unique powder metal press features as . . . hydraulic heads, shuttle type feeders, independently floating die and core rod, automatic lubrication and variable cycling. It's no wonder that initial tests prove that these new Baldwin presses can out-produce competitive models by 200%, turn out compacts to closer tolerances and eliminate costly grinding operations.

You'll find more information and specifications on these new presses in our Bulletins 3101 (C) and 3104 (L). Write Dept. 4802, Baldwin-Lima-Hamilton Corporation, Philadelphia 42, Pennsylvania.

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BALDWIN-LIMA-HAMILTON

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Any way you figure it—speed, accuracy, squareness or cost—a hack saw will far out-perform a band saw when it comes to cutting-off from bars or billets. As builders of both band saws and hack saws we frankly admit this.

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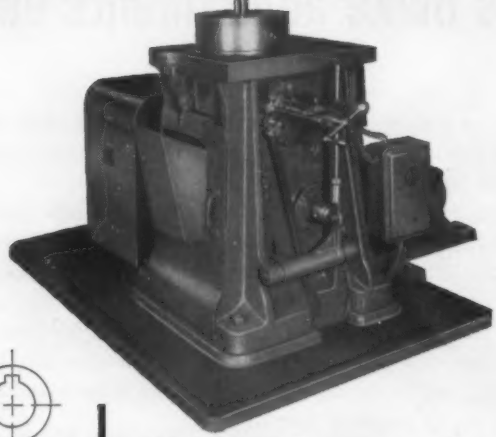

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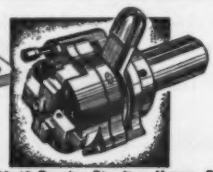

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24"x24' centers LeBlond Patent head
25"x18' bed Sidney 3 SCD lathe, 12' center distance
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36"x18' bed American, 12 speeds, center distance 12'.
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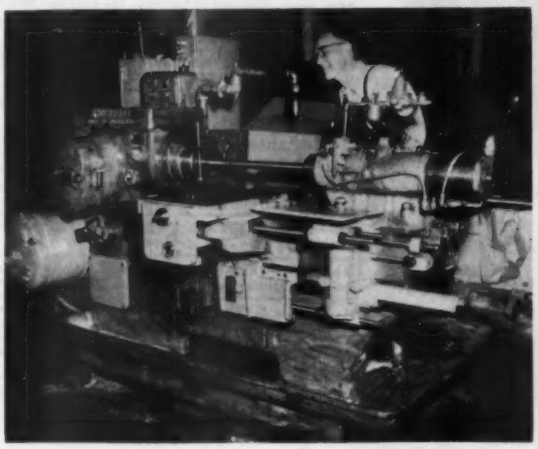

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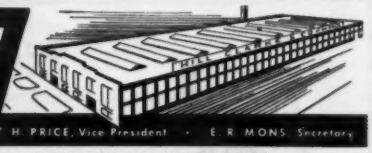

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No. 2MA6 Avey—1 spdl.—24" sw.
No. 4MS—1 Spdl.—Leland-Gifford
No. 422 Baker—1 Spdl.—24" sw.
No. 2LMS L-G—2 spdl.—20" sw.
No. 3 Avey—3 spdl.—24" sw.
No. 2MS Allen—3 spdl.—24" sw.
No. 2 LMS L-G—4 spdl.—14" sw.
No. 3B Edlund—6 spdl.—30" sw.
No. K60H Fox Multiple

GEAR MACHINES

11" Gleason Gear Generator
No. 36BM Gould & Eberhardt
No. 615A Fellows Gear Shaper
No. 612A Fellows Gear Shaper
No. 65 Fellows, Cone Drive
No. 12HS Gould & Eberhardt

GRINDERS

No. 4H—4"x12" Landis Plain Cyl.
3"x30" Norton Cam-O-Matic
5"x42" Norton Type C Pl.
6"x18" Norton Type C Plain
8"x15" Elgin BB-5C
10"x18" Norton Type C Pl. Cyl.
10"x36" Norton Type C
10"x36" Norton Type C Cam Gdr.
14"x48" Landis Type C Plain
14"x48" Landis Univ.
16"x36" Norton Type C Pl.
16"-26"x72" Norton Pl.
16"-46"x48" Landis Type D Pl.
18"x120" Norton Type A Plain
20"-32"x144" Norton Gap
20"x192" Norton Type A Plain
24"x264" Norton Type A Plain
No. TG615 J. & L. Thread Grinder
No. 31 Heald Int. Centerless
No. 74 Heald Int. Centerless
No. 72-A Heald Univ. Int.
No 72AS Heald Int. (1942)
No. 5 Bryant Internal
No. 5A Bryant Hole & Face
No. 5B Bryant Internal
No. 16-16 Bryant Internal
No. 16-28 Bryant Internal
No. 16A16 Bryant
No. 16A-28 Bryant Internal
No. 16F-28 Bryant Internal
No. 16-38 Bryant Internal
No. 24-26 Bryant Internal
No. 24-36 Bryant Internal
No. 24L-36 Bryant Internal
A3-16 Arter Surf. (1942)
No. B24—25" chuck Arter Surf.
No. 214 Besly Dbl. End Disc
#3 Badger Hanchett Double End Disc.
Hill-Clarke Cyl. Norton Type M.D.
10"x36" centers
10"x72" centers
10"x96" centers
14"x36" centers
14"x50" centers
14"x72" centers
14"x96" centers
18"x96" centers
18"-30" gap x 96" centers

LATHES

12"x21" Fay Automatic
16"x21" Fay Automatic (1944)
16"x32" R-14 Seneca Falls
16 ML 16 LeBlonde Semi-Auto.
18"x51" cc American Grd. Hd.
27"x84" cc American Geared Hd.
36"x120" cc Putnam Geared Hd., M.D.
No. 2 Warner & Swasey Grd. Hd.
No. 5W Acme Universal
No. 6 Warner & Swasey, bar fd.
No. 7A Jones & Lamson
No. 1A Warner & Swasey
No. 2A Warner & Swasey
No. 3AL Gisholt Cross Slide
No. 3H-16 Libby International
No. 3A Warner & Swasey Turret Lathe
No. 4A Warner & Swasey M.D.
No. 4A Warner & Swasey (1944)

MILLING MACHINES

No. 2HL K. & T. Milwaukee Plain
No. 4 Cincinnati Dial Type Plain
No. 0S Cincinnati Vertical
118 Van Norman Hyd. Mfg. (1942) Model A Briggs Mfg.
54"x30"x16' Ingersoll Slab
10"x60" Pratt & Whitney Thread
12"x102" HT Lees-Bradner Thread
Model CT Lees Bradner Thread Mill (1942)
No. 118 Van Norman Hyd. Mfg.
No. 1-18 Cinn. Mfg.

PLANERS

48"x36"x14' Gray
60"x48"x27' American, 4 heads

MISCELLANEOUS

No. 2L-6 La Pointe Horiz. Hyd. Broach
8 Spdl.—6" Goss & DeLeeuw Chucker
No. 56 Sundstrand Double End Cent. Mach.
Foote-Burt 1 Spdl. Boring Mach. (1941)
15" Dill Slotter
18" Dill Slotter
Model 200 Micromatic Hor. Hone
Model H-7 Micromatic Vert. Hone
No. 224 Barnes Vertical Hone
No. 306 Barnes Vertical Hone
No. 6 R. & K. Straight Side Press
15 Ton Amer. Hyd. Press
[illegible] Economy Shear M.D.

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27"x18' MONARCH "N" Geared Head Lathe, 11' centers, Taper Attach., Full Equipment, Late Type, 1942.

18"x10' MONARCH "BB" Grd. Hd. Lathe, 72" centers, Taper Attach., Flame Hardened Bed, Late Type.

24", 36", 42" BULLARD Vertical Turret Lathes, New Era, Turret Hd., Side Hd. M.D.

No. 2, 4, 5, 1A, 4A WARNER & SWASEY Univ. Turret Lathes, Bar Feed.

24"x10' AXELSON Geared Hd., H.D. Model "E" 28" Actual Swing, M.D., Taper Attach.

No. 7 BARDONS & OLIVER Universal Turret Lathe, 2½" capacity. Preselector Head.

25"/50"x12' LeBLOND Sliding Bed Gap Lathe, Geared Head.

MILLING MACHINES

No. 2-18 CINCINNATI Plain Auto. M.D., Late

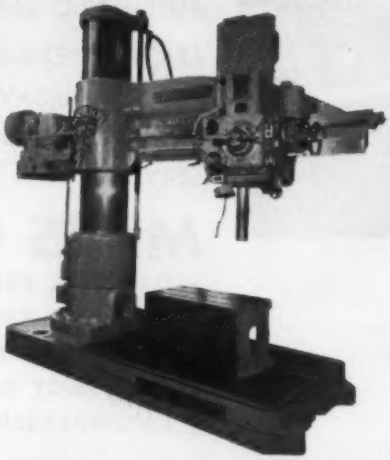
No. 2 BROWN & SHARPE Vert. Mill, Light Type, Swivel Head, M.D., Late.

No. 1-8 KENTS OWENS Hydraulic Horiz. Mill, Late Type, M.D.

6' arm x 17" column FOSDICK Economax Hydraulic Radial Drill, Motor on arm, late type. 1944

4'x15" CARLTON Radial Drill. Motor on arm.

DRILLING MACHINES



6' ARM x 19" COL. CARLTON RADIAL DRILL, 20 HP., LATE TYPE, 1943

No. 262 BARNES Motor Driven Sliding Drill Press, 2" cap. in steel, 1941.

No. 2 M. T. Six Spindle ALLEN Type KH Drill Press, Individual Motor Drive, Late Type.

400 tons CHAMBERSBURG Hydraulic Wheel Press, 14" Ram, 96" between Tie Bars, 12' to End Support. M.D.

No. 0, 1, 2 BUFFALO FORGE Vertical Angle Bending Rolls, M.D.

No. 6 FEDERAL O.B.I. Press, 65 tons, cap., single geared, 4" stroke, M.D.

½, 1⅓ BUFFALO FORGE Universal Irenworker, Notcher and Coper, M.D.

36" ROCKFORD Hydraulic Openside Shaper, with Side Head, Late Type.

No. 20 WATERBURY FARREL Thread Roller, ⅜" cap. 1944, Motor Driven.

No. 8LS FELLOWS M.D. Gear Lapping Machine. Detachable Head, Univ. Work Support.

No. 00G BROWN & SHARPE High Speed Automatic Screw Machine. M.D. Late type.

10"x10" RACINE #30-C Hydraulic Heavy Duty Shear Cut Power Hack Saw, 1946.

10' x ¼" WYSONG & MILES Power Squaring Shears, Motor Driven.

GRINDERS

30" INGERSOLL Face Mill Cutter Grinder, M.D.

6" x 18" LANDIS Type "C" M.D. Hyd. Cylindrical Grinder, Serial #29196.

#3 Brown & Sharpe Univ. Cyl. Grinder, M.D.

#TG848 JONES & LAMSON Thread Grinder, Lathe, M.D.

No. 208 BESLEY Motor Driven Disc Grinder, 26" wheels, Late Type.

No. 194 BARNES Vertical Hone, 4" capacity, 12" stroke, Motor Driven.

3" UNIVERSAL Horizontal, Boring, Milling, Drilling Machine. Table Type Oil Grooved Table 32½" x 58"; 12 spindle speeds 16 to 650 RPM; 72" cap. to end support. M.D. Late Type.

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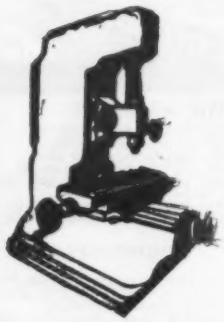

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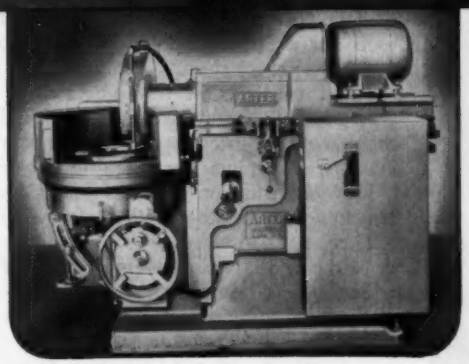
The Arter Family of Machines

CARBIDE TOOL GRINDERS



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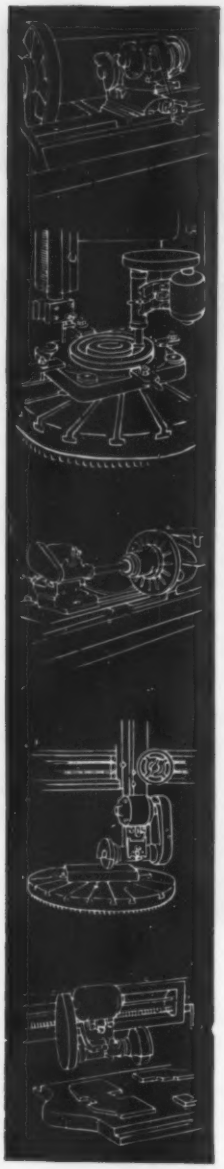

External Grinder with two Internal Spindles which are interchangeable with External Spindle on machine.

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These versatile Grinders can be mounted on lathes, planers, boring mills, milling machines and other machine tools for a large variety of grinding operations which crop up in every shop.

Rigid construction throughout with large precision type bearings insure accuracy for production and tool room work. Constant speed motors provide the uniform wheel speed so vital for best grinding results.

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Large flat pad with several bolt slots adapts the Grinder to the regular tool holding fixture of the machine on which it is to be mounted.

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Other "HISEY" Products: Bench and Pedestal Grinders and Buffers; Snagging Grinders; Wet Tool Grinders; Disc Grinders; Drill Grinders and Dust Collectors.

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From the *American Machinist* Library of *Tips for Top Shop Men*

TWO of management's most important words are "know" and "no." If you're strong on the first, you seldom hear the second.

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MILLING *and* CENTERING *simultaneously and in continuous production*

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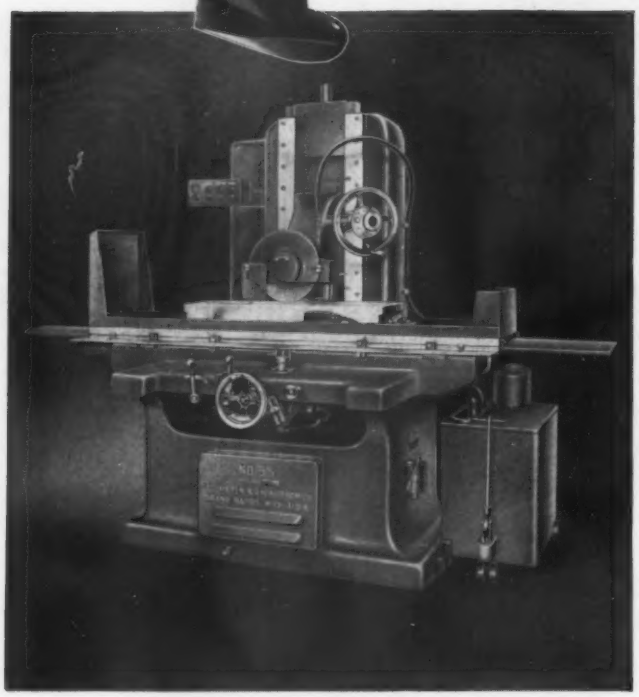
FOUND WHERE WORLD FAMOUS AIRCRAFT ARE "BORN"

GRAND RAPIDS GRINDERS



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This precision tool room type machine has table speed up to 125 fpm. Working surface of table is 12" x 36". Vertical movement of wheel head 18". Preloaded ball bearing spindle greased for life. Spindle speeds 1925 and 2500 rpm.

Just a note on your letterhead will bring you full details.

Just take a look in their toolrooms! Every one of these famous aircraft manufacturers uses Grand Rapids Grinders . . . depends on them for the uncompromising precision on which records and reputations are made.

Grand Rapids Grinders are engineered and built for unusual long life of precision grinding. Our Model 55 shown here, for instance, features column and base of massive, one-piece casting for vibrationless rigidity and permanent alignment. Both longitudinal table travel and cross feed are hydraulically actuated. Wheel head has powered rapid vertical travel. Table speed is variable up to 125 fpm . . . faster than any other of this type and size.

That's why so many tool room men insist on Grand Rapids Grinders.

GALLMEYER & LIVINGSTON

GALLMEYER & LIVINGSTON COMPANY 430 Straight Ave., S.W., Grand Rapids, Michigan

HOLO-KROME'S MODERN PACKAGING SLASHES YOUR HANDLING COSTS—

. . . all along the line!

From receiving room, to stock room, to production line, to finished product . . . at every step of the way through your plant, Holo-Krome's new packaging saves time and money!

ASSURES FASTER ORDER HANDLING Now, all 7/8" and 1" Socket Cap and Set Screws are packed in new TEN-PAK boxes . . . 1¼" and 1½" Socket Cap Screws in ONE-PAK boxes!

GIVES TIGHTER INVENTORY CONTROL Your stockroom men can now take inventory of Holo-Krome products at a glance! New and smaller clearly labeled boxes are easier to stock and check . . . no lost and wasted screws on the job!

SCREWS ARE FULLY PROTECTED Holo-Krome wraps each TEN-PAK screw in heavy corrugated cardboard liners. Threads can't be damaged, finish can't be marred!

Companies using Holo-Krome products are reaping the benefits of these time-saving, cost-cutting advantages. YOUR COMPANY CAN TOO! Make your Holo-Krome Distributor prove to you how H-K's new packaging saves both time and money!

Call him right now!

For the finest in fasteners . . . the fastest service . . . the best in packaging . . . look to your Holo-Krome Distributor.

HK

HOLO-KROME

THE HOLO-KROME SCREW CORP. HARTFORD 10, CONN.

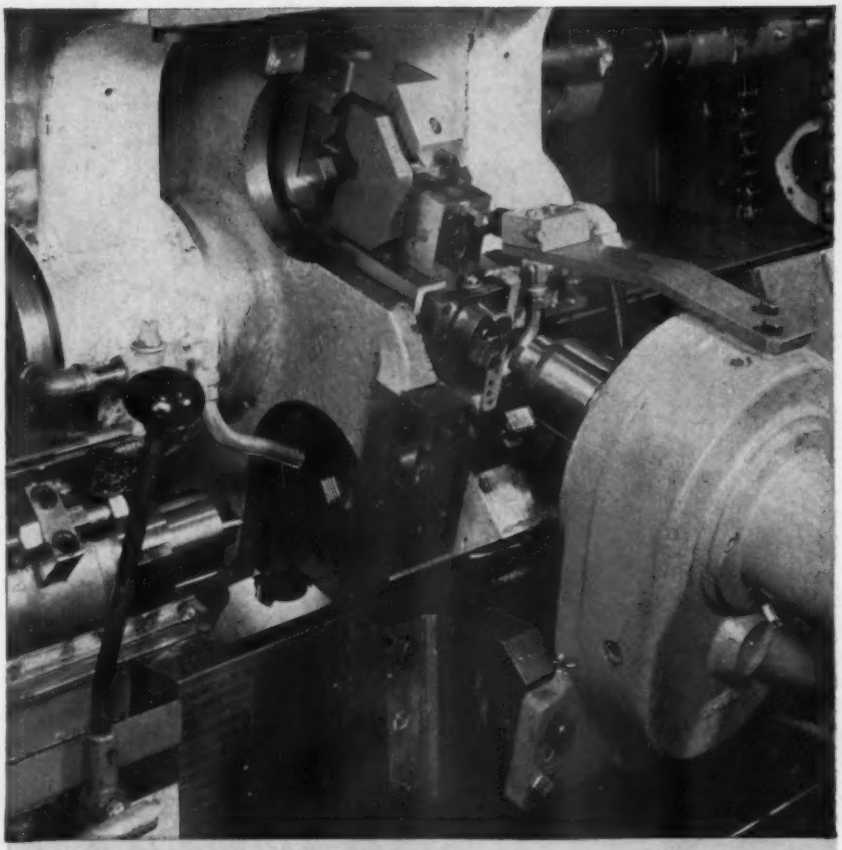
More precision — no more backlash after turret was mounted on TIMKEN® bearings

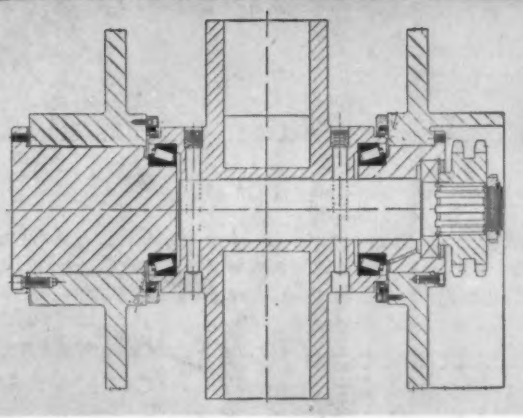
50 Timken® bearings are used in this Model 365 New Britain chucking machine, which can machine both ends of suitable castings or forgings simultaneously. The turret spindle of this machine was originally mounted on a plain bushing. This method did not eliminate backlash completely. When Timken tapered roller bearings were mounted at each end of the turret shaft, backlash was eliminated altogether, rejects cut. Timken bearings also prevent chatter and insure precision because they can be preloaded to any degree necessary to maintain the required rigidity.

Timken bearings can handle heavy loads because they carry them on the lines of contact between rollers and races. Their tapered construction permits them to take radial and thrust loads in any combination. Geometrically designed for true rolling motion and precision manufactured to live up to their design, Timken bearings practically eliminate friction.

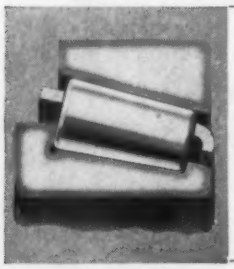
We even make our own special analysis nickel-rich steel to be sure Timken bearings are the best. We're the only U. S. bearing maker that does. When you buy or build machines, always specify Timken bearings. Look for the trade-mark "Timken" on every bearing. The Timken Roller Bearing Company, Canton 6, Ohio. Canadian plant: St. Thomas, Ontario. Cable address: "TIMROSCO".

This symbol on a product means its bearings are the best.





How **THE NEW BRITAIN MACHINE COMPANY** mounts the turret of its Model 365 Double-End Automatic Chucking Machine on Timken bearings to improve precision, minimize maintenance.



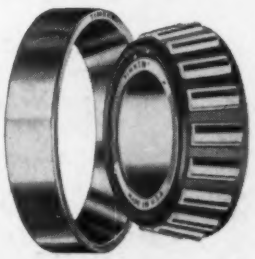
GREATER LOAD AREA

Because the load is carried on the *line* of contact between rollers and races, Timken bearings carry greater loads, hold shafts in line, wear longer. The Timken Roller Bearing Company is the acknowledged leader in: 1. advanced design; 2. precision manufacturing; 3. rigid quality control; 4. special analysis Timken steels.

TIMKEN

TRADE-MARK REG. U. S. PAT. OFF.

TAPERED ROLLER BEARINGS



NOT JUST A BALL ○ NOT JUST A ROLLER ⬭ THE TIMKEN TAPERED ROLLER ⬭ BEARING TAKES RADIAL ◎ AND THRUST →◎← LOADS OR ANY COMBINATION →✳←